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The Tramcar

MUCH of the prevalent criticism of the tramways fails to take into account that no other method of street transport can deal so effectively with large crowds. Nor can we see in any likely engineering developments of the near future a practicable successor where the traffic density is high.

The issue has been confused by the good results that have often followed the substitution of buses, whether of the trolley or petrol-driven kind, and also in some cases by the expectation of still further economies from the recent technical improvements in the heavy-oil engine.

The real position is that the towns in which the tramways have been scrapped are those where modern traffic conditions make their use unsuitable. When the systems were laid down trams doubtless provided the best solution of local transport problems, but other and more suitable methods have since been developed for areas in which slow traffic densities and narrow streets are deciding factors.

There is, however, a broad margin where the claims of the rival methods compete—and they compete much more fiercely than they need, owing to the lack of authoritative co-ordinated data as to relative performance in specific cases.

We are not here concerned with such extraneous considerations as the effect of the loss of contributions towards road upkeep and local rates and of a valuable electrical load that would follow the victory of the petrol bus, but we do desire to see that the merits of the tramcar as a conveyance are fully appreciated in these very many marginal instances.

It is of the first importance—and the warning is seemingly necessary—that tramcars of the older type, some of which have been in use for twenty years, should not be compared with the most recent types of bus. What technical improvements have done and are doing for tramway stock will be appreciated from a study of the papers that are being read before the annual congress of the Tramways, Light Railways and Transport Association this week.

Progress is chiefly in the direction of reducing the weight of motors, increasing the strength of control equipment and also of gearing, higher speeds and quicker acceleration and retardation, and field control and regenerative braking. Transport authorities are faced with a load factor problem at least as acute as that which exercises the minds of electricity supply engineers, and Mr. W. H. Shaw's argument is sound that as the tramcar must have a high degree of comfort in the slack hours with capacity in the rush hours the permitted ratio of standing passengers to seating accommodation should be increased.

We do not, however, share Mr. Shaw's suspicion of new "gadgets." We are much more inclined to support Mr. G. H. Fletcher's suggestion to introduce remote control equipments, in spite of the somewhat lukewarm nature of Mr. G. F. Sinclair's reference to them. We believe that the increasingly trying conditions involved in driving at the high speeds necessary in modern traffic call for the reduction of manual effort to the very minimum if the tramcar is to retain its place in the margin in which it is open to competition from other vehicles.

A New Branch

THE Electrical Trades' Benevolent Institution opened a South Coast branch last week. The inauguration took place at a meeting held at the Brighton Corporation electricity offices, with Mr. Allen West, the immediate past-president, in the chair. Mr. H. F. Reason will act as honorary secretary, and the committee will include the borough electrical engineers of Brighton (Mr. W. N. C. Clinch), Eastbourne (Mr. J. K. Brydges), Tunbridge Wells (Mr. R. N. Torpy), and other towns, as well as representatives of electrical manufacturing and other interests. The names of Allen West and Reason have long been prominently identified with the electrical industry at Brighton, and it is appropriate that they should give local leadership in a cause which is so well worthy of support. In times like these both the calls upon the Fund and the responsibilities of those who administer it are great. We are not sure that its real and original objects are as widely known

and as clearly understood as they might be to-day. Perhaps through the new branch, and the committees operating in other areas, the position may be clarified and a wider interest aroused. Mr. Allen West has described the Fund as having acted as both "father and mother" to many men and their dependants in time of difficulty. Beneficiaries know; members of the Executive know; and so do we, what a boon it has been. If only the story of relieved anxiety and ameliorated suffering could be effectively told!

The Stuart Street Boilers

IT seems strange to hear of boilers in a selected station that are more than thirty years of age. The eight (out of fourteen) veterans which Mr. Lamb recommends for supersession have a combined capacity of 160,000 lb. per hour, so they must have been regarded as really large units in their young days. The two replacement boilers will have a combined capacity of 200,000 lb. per hour, and will cost £75,000, with air heaters, fans, and other auxiliaries and building alterations. The space made available allows for the future installation of two further boilers of the same capacity. The figures of new connections to the Manchester system given by Mr. Lamb recently indicate that a trade revival will make heavy calls upon the generating resources of the area.

Wiring Symbols

IN the ELECTRICAL REVIEW of January 8th last, Mr. H. R. Taunton drew attention to the confusion and loss of time and money which were caused by the lack of a definite code of wiring symbols. Every contractor and architect seems to have his own hieroglyphics which, though they appear as plain as a pikestaff to him, puzzle those who have to handle his drawings. We are glad to see that the British Standards Institution has now taken the matter in hand and has published recommendations. Altogether it puts forward fifty symbols which seem to meet most common needs. The user of the characters will need to have the chart on the wall of his office for ease of reference, and this is provided for; he will also have to be something of an artist if his drawings are to be presentable.

Students' Responsibilities

THE executive committee of the London Students' Section of the I.E.E. in its report for the past session refers to the greater interest shown in discussions and the improvement in their quality. This is certainly gratifying; so also is the news that the number of those desirous of taking a "'busman's holiday" by visiting works on Saturday afternoons has generally been in excess of the maximum number invited. On the other hand, the average attendance at meetings once more shows a decline from the previous year, although the papers read should have proved attractive. If any members of the Section (who total nearly 1,650) have any ideas for securing a better average attendance than ninety-six they should remember that the Section is definitely their own to make what they want of it. They might also feel the pride of responsibility, in that the future of the most quickly developing profession is very largely in their hands.

Electrified Lettuce

AN amusing leader in *The Times* dealing with the use of electricity in horticulture suggests that while it may be desirable to slaughter slugs by its agency, there may be a danger of shock to children playing in the garden. As Mr. Cramb, director of E.D.A., points out in a rejoinder, published in the correspondence columns of the same paper, electricity has a much lower accident rate than certain other domestic services. Whether, as it is alleged, good results come from giving lettuce shocks, we have as yet received no tangible evidence, but there is no doubt that the warming of the soil by buried cable in the spring can give us an advantage in time in competing with foreign produce. What is, we find, not so generally realised is that in some cases vegetation has also a prolonged useful life due to the same cause. This was clearly brought out in the experiments upon cucumbers conducted by Mr. C. T. Allan in South Wales in 1930, and reported by us at the time. In that case the yield was found to be four times as great as without soil heating.

Electricity and the Architect

SOMETHING is seriously wrong when drawings and reports for the designs of buildings of over 1¼ million cu. ft. capacity, to cost, say, £200,000, contain little or no provision for electrical equipment. The vital necessity for co-operation between architects and electrical contractors has been stressed for many years, and lately there has been signs of improvement. Closer working is an urgent matter, and we hope that strong electrical support will be given to the permanent Building Centre in Bond Street (ELEC. REV., March 11th, p. 390), which opens in June, as a means to that end. Transformers, switchgear, cables, etc., must be housed, and where there is no initial provision for them, plans must be altered to the detriment of both the general scheme and the electrical installation. And the same applies to lighting equipment. The greatest advantage of modern concealed lighting can only be obtained where it is "built in."

A Case in Point

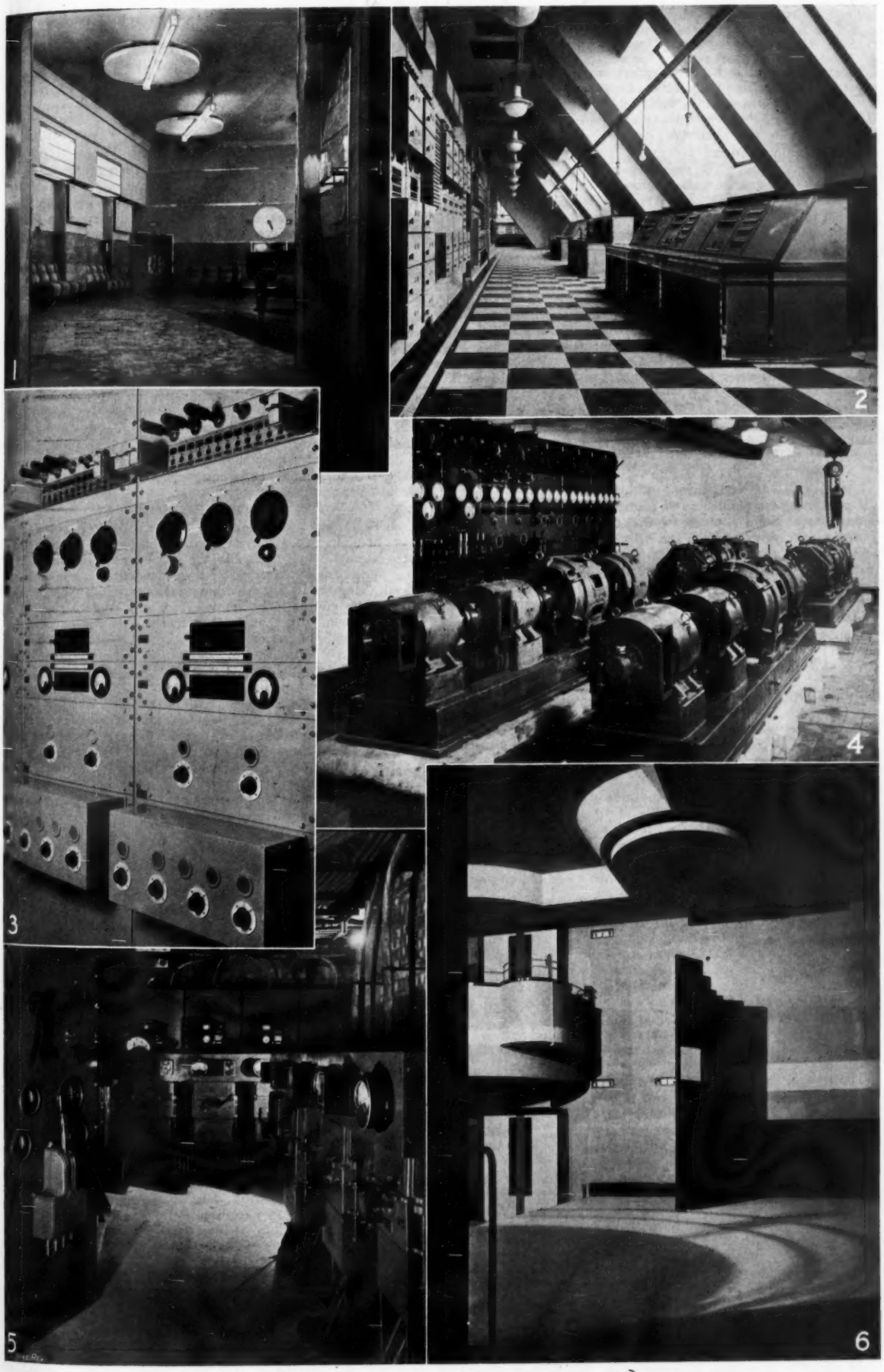
WE inspected this week many of the hundred odd plans, etc., for the proposed new building of the Royal Institute of British Architects in Portland Place, London, submitted as the result of a competition. Probably not more than a dozen show any provision for switchgear, cables, etc., or even give the positions of the sources of artificial lighting. It is certainly complimentary to the electrical industry that electric lighting is taken for granted. "The artificial lighting is concealed" is a phrase typical of how the subject is treated and dismissed. Many architects do not seem to know that electric heating can be effected practically and economically. "Central heating will be employed, and the boilers will be in the sub-basement," suggests that there is only one known method of heating. But we were glad to see provision by a few exhibitors, including Mr. G. Grey Wornum, winner of the first prize (£500), for electrical thermal-storage heating. Mr. Wornum's plans also allowed reasonable space for "electricity intake" and "switchgear" separately.

Wasteful Competition

LAST week, in commenting on the competition of oil with electricity, we referred to the disadvantageous position of statutory authorities, who cannot pick and choose their consumers, with their "pirate" rivals. The position of the railways is somewhat analogous. They are a vital necessity for dealing with the base-load traffic, as Sir Herbert Walker reminded the special committee of the Minister of Transport. Their loss of revenue to the buses has been mainly due to the defection of the ordinary passengers; they still retain the less profitable workmen's traffic. When the present chaos of redundant conveyances has been cleared up we hope the railway companies will realise that electrification provides the surest way of obtaining their fair share of the better paying traffic.

Wireless-only Consumers

MINIMUM charges for small consumers have always been a cause of irritation, but the growing popularity of all-mains wireless sets introduces a new factor. At Burton-on-Trent a minimum charge of £1 per annum is to be introduced, as so many applications are being received for supply for radio receiving sets only. We hope this will prove a passing phase, and that Mr. Hall will find that he is able to persuade such unremunerative consumers to use electricity for other purposes that will bring their annual bills to considerably more than the minimum proposed.



The new headquarters of the British Broadcasting Corporation

(1) Studio: note lighting fittings and ventilators. (2) Control room. (3) Check receivers. (4) Battery charging sets and switchboard. (5) Power intake switchgear. (6) Vaudeville studio stage: note ventilator and invisibility of lighting fittings.

D

Broadcasting House

Novel arrangements in the new B.B.C. headquarters

THE last of the B.B.C.'s programmes from Savoy Hill was radiated on May 14th. Its new home in Portland Place, London, W., is very different from the premises it has occupied for nearly ten years. The building is novel in architectural design, with very modern, but restrained and entirely pleasing, interior decoration and lighting.

The electricity supply arrangements provide more than the normal factor of safety against interruption. The St. Marylebone Borough Council Electricity Department has laid six separate intake feeders into the sub-basement, three at 6,600 V and three at 415 V, 3 phase, 50 cycles; air-cooled transformers interconnect the high and low voltage feeders. The power and lighting distribution switchgear is of the normal ironclad type. A 240-V, 1,000-Ah battery provides emergency lighting in all studios, corridors, staircases, &c., inside the central tower. This supply is normally switched on at the same time as, and forms parts of, the main lighting. Should, therefore, a fault develop on the main supply, the studios will not be plunged into darkness.

A motor generator floats the storage battery, so that it is kept fully charged. If the failure is such as to affect all feeders and the breakdown is likely to be of more than half an hour's duration, a 100-kW Diesel-driven generator set can be started to take over the load from the storage battery.

Ventilators and Lifts

The larger part of the power load is due to the ventilating and air conditioning plant in the sub-basement, which is served by a ring main from the distribution switchgear. The supply to the rest of the building, including the ventilating plant on the roof, is fed to the various floors through cables arranged in accessible vertical ducts formed in each side of the central tower and continuing from the sub-basement to the top of the building.

Four passenger lifts are installed, two of them being inside the studio tower, while the other two communicate with the office corridors on each floor; in addition, there are two large goods lifts. Ward-Leonard control minimises interference.

Broadcasting House contains twenty-two studios of widely varying size; their volumes range from 670 to 125,000 cu. ft.

Each group is in a self-contained suite, embodying artists' waiting rooms, announcing rooms, listening rooms, &c. The provision of a small announcing room adjoining each studio, sound-proofed from the studio itself, but with windows through which the announcer can see the artists in the studio, is a somewhat novel development.

There is a listening room adjacent to each studio with a double window through which the studio can be seen. These rooms are acoustically treated to be suitable for high quality reproduction.

Microphones and Control Room

In recent years the B.B.C. has used the carbon microphone, but a change is now gradually being made to the condenser type. A number of microphone plug points is installed in all the large studios and the output of each microphone is fed to a mixing unit in the listening room adjacent to the studio. Thus the combined output is passed on a single pair of wires to the input of the first or "A" amplifier in the control room. This arrangement facilitates the balancing of transmissions and to some extent it obviates the need to move artists about during a performance.

The control room is situated at the top of the building and is divided functionally into two halves, *i.e.*, rehearsal and transmission. It contains all the amplifiers and auxiliary equipment required in the chain of transmission between any studio (or outside broadcast point) and the s.b. lines feeding the transmitters.

Three amplifiers are used in sequence: a microphone "A," a variable gain "B," and a land line "C" amplifier. "A" amplifiers are of the three-stage type, resistance-capacity coupled, but with input and output fed through transformers. The last stage consists of two valves with grids connected in parallel and separate anode circuits, so that the output of the "A" amplifier can be split and fed to an echo room amplifier, if artificial echo is required. These "A" amplifiers have a maximum gain of 50 decibels, and a working gain of approximately 40 decibels. There are in all thirty-one "A" amplifiers (of which three are normally spares).

The "B" amplifiers are of the three-stage type with resistance capacity inter-stage coupling, the inputs and outputs being fed through transformers. The gain of each is 46 decibels, and is variable over a range of 35 decibels by a volume control potentiometer, but they are set, normally, for a gain of approximately 38 decibels. Immediately preceding each "B" amplifier is a main volume control which gives a variation of 2 decibels per stud and this is used for controlling the strength of the transmission and for fading-out purposes.

Land-line Amplifiers

The function of the land line "C" amplifiers is twofold. First, they act as "trap" valves with all their inputs connected to the outgoing programme (*i.e.*, the output of the "B" amplifier) but with their outputs isolating each trunk line connecting to the various transmitters or distribution points. Thus trouble of any sort on one line is prevented from interfering with the service on another. Secondly, if the volume is insufficient on, say, the London-Leeds s.b. circuit, the gain of that "C" amplifier can be increased without a corresponding increase occurring in the volume of the programme on, say, the London-Daventry land line. There are in all twelve "C" amplifiers, each having two 10-W power valves in the output stage.

In addition, there is also installed in the control room a fourth type of amplifier which is used when an incoming transmission from some distant point, such as a provincial studio centre or an o.b. point is received in the control room. The "D" amplifier raises the incoming transmission to the same level as the average level output of the "A" amplifier. Thus it can be fed directly to the "B" amplifier. There are in all six "D" amplifiers, each designed for a maximum gain of 36 decibels.

Control Positions

There are six transmission and eight rehearsal control positions or desks in the control room, and these are of an entirely novel design. In addition to the usual studio signalling keys and lights, each control position is fitted with a complete set of punching keys. They operate a series of relays which enable any studio circuit to be set up from any control position in one operation. By "set up" is meant that the microphones are polarised, the various power supplies switched on to that studio's "A" amplifier, and the necessary connections made between the output of that studio's "A" amplifier and that particular control position.

Another important development is visible indication of the audible strength of the programme. This "programme meter" is calibrated in equally spaced divisions and each division represents a change in sound intensity of 4 decibels.

Three elaborate quality-checking receivers are installed in the control room, which also contains equipment for measuring the response of land line circuits at all audio frequencies, and corrector circuits are available, since in some cases the frequency response can be improved by their insertion into the chain.

By various alarm circuits those on duty are warned immediately a fault develops.

Valve Batteries

All the valves in the control room, some 400 in number, are energised by banks of batteries in duplicate: 6 V, 3,150 Ah for filament heating, 300 V, 50 Ah for anodes, 8 V, 500 Ah for polarising carbon microphones, and 24 V, 600 Ah for relay operation. While one bank is on load the other is being charged by motor generators situated in a room immediately adjacent to the battery room. The generators are driven by induction motors, and the outputs of the d.c. machines made variable over a wide range by the use of separate exciters.

The contractors include: Lifts, Waygood Otis, Ltd.; clocks, Synchronome Co., Ltd.; electric light and power wiring, Troughton & Young, Ltd., and Smith & Hammond, Ltd.; relays and telephones, Siemens Bros. & Co., Ltd., and Ericsson Telephones, Ltd.; control apparatus and racks, Plessy Co., Ltd.; batteries, Chloride, Tudor & Hart Companies; motor generators, Normand Electrical Co., and Laurence, Scott and Electromotors, Ltd.; switchboards, Whipp & Bourne, Ltd., Erskine Heap & Co., Ltd., Electrical Apparatus Co., Astral Engineering Co., and Ferguson Pailin, Ltd.; motor starters, Brookhirst Switchgear, Ltd.; stand-by Diesel alternator, Crossley Bros., Ltd., and General Electric Co., Ltd.; heating, air conditioning, and ventilation (electrically driven, oil fired), Carrier Engineering Co., Ltd.; electrical fittings, General Electric Co., Ltd., Best & Lloyd, Ltd., and Troughton and Young, Ltd.; motors, English Electric Co., Ltd.; lightning conductors, J. W. Gray & Son, Ltd.; transformers, British Electric Transformer Co., Ltd.; cables, British Insulated Cables, Ltd., Callenders Cable and Construction Co., Ltd., London Electric Wire Co., and Smiths, Ltd., and Pirelli-General Cable Works, Ltd.; rectifiers, Westinghouse Brake and Saxby Signal Co., Ltd.; ringing machines, Haslam and Newton, Ltd.; radio valves, G.E.C., and Marconi Co.; vacuum cleaning plant, Sturtevant Engineering Co., Ltd.

Electric Traction Motor Gears. By Brian Reed

EXCEPT for the highest powers and speeds the great majority of electric railway vehicles are driven by motors of the nose-suspended tramway type. Space between the wheels being limited, it is usual to employ single spur gearing, but where space allows twin gears are to be preferred in order to eliminate torsional effects.

The ratio of the gear reduction is determined by the maximum speed of the vehicle, the size of the wheel, and the motor speed. So far as railway conditions are concerned, it is often difficult to obtain the required clearance between the rail and the bottom of the gear case, the minimum in this country being usually 6 in. with new tyres. This difficulty does not apply with equal force to tramcars, on which the clearance may be as low as 2¼ in. In addition to the rail clearance, the peripheral speed of the gearing may prove a limiting factor. For economical motor design the armature and gears should both reach their maximum safe speeds at about the same time. The generally accepted figures are 7,500 ft. per minute for the former, and, when grease lubrication is employed, 4,000 ft. per minute for the latter. On large electric locomotives incorporating individual axle drives, with forced lubrication, speeds of over 6,000 ft. per minute obtain.

Consider a multiple-unit electric train with wheels having a diameter, when new, of 3 ft. 6 in. driven by axle-hung motors at a maximum speed of 60 m.p.h., and a gear reduction of 2.81 : 1 on 20-in. centres. With wheels worn to 3 ft. 4 in. diameter the r.p.m. at 60 m.p.h. will be 504, and the motor revolutions 1,418. The peripheral speed of the gears is 3,900 ft. per minute, and that of the armature (19.5 in. diameter) 7,250 ft. per minute. But it is not always possible to obtain such good figures as provided by this actual example.

Railway traction motor gears have usually a diametral pitch of 2, but this varies from 2½ in the smaller to 1½ in the larger sizes. The form of tooth employed is the 20 deg. involute, which, in addition to manufacturing advantages, is the strongest of the normal profiles, and maintains its accuracy of rolling contact when the centres are slightly displaced. In some instances "Maag" gears have been used with success. By the use of a special profile these gears can carry a heavier load than the usual type, and it is claimed that peripheral velocities of 10,000 ft. per minute are practicable.

For small work the material of which the gears are made is a forged steel, containing one or two per cent. of nickel, and having an ultimate strength of some 40 tons per sq. inch. Case-hardening steels, with a carbon content up to 0.75 per cent. are occasionally used in railway work, and more frequently in tramway practice. These steels have a greater wear resistance than alloy steels, but are lacking in other respects. Even a non-case-hardening steel having a high carbon content is better, strength for strength, than a nickel steel from the wear point of view. But a material with greatly enhanced strength becomes necessary for the severe conditions of large powers, and high-grade alloy steels are extensively used.

Representative specifications are as follows :—

Pinions.—Cut from a solid block of air-hardened nickel-chrome steel, having an ultimate tensile strength of 100 tons per sq. in., with a yield point of 84-85 tons per sq. inch.

Analysis.—Nickel 4.0 per cent., chromium 1.5 per cent., carbon 0.4 per cent., sulphur 0.03 per cent. max., phosphorus 0.03 per cent. max., manganese 0.4 per cent., and silicon 0.2 per cent. Elongation in 2 inches, 10 per cent. min.; Izod impact value, 10 foot-lbs.; Brinell hardness number, 444.

If a small amount of molybdenum—say, 0.2 to 0.3 per cent.—is added to the above steel, the brittleness will be decreased, and a higher impact value obtained. The pinions are keyed to the armature shaft, and secured by a nut, the bore being tapered at the rate of 1 in 6 to 1 in 10. Further, they are boiled just before putting on to the shaft, and have thus the added security of a slight amount of shrinkage, while the temperature is not sufficient to affect the temper of the steel.

Gear Wheels.—Cast in one piece, of nickel-chrome steel having an ultimate tensile strength of 55 to 65 tons per sq. in., and a yield point of 44 to 50 tons per sq. in.

Analysis.—Nickel 3.25 per cent., chromium 0.9 per cent., carbon 0.35 per cent., sulphur 0.03 per cent. max., phosphorus 0.03 per cent. max., manganese 0.55 per cent., and silicon 0.2 per cent. Elongation in 2 inches, 18 per cent. min.; Izod impact value, 35 foot-lbs.; Brinell hardness number, 255 to 293.

In the ordinary way the gear wheels are forced on to the axle with a hydraulic pressure of 10 to 15 tons per in. diameter of gear-wheel seat. Keys are not always fitted, and, judging by results in service, they do not appear to be necessary. The gears are cut before being pressed on the axle. There are a number of instances of the use of gear wheels forged in two pieces, and secured to an extension of the road-wheel boss, but the advantages of this are purely local.

Some Driving Forces in the Industry: Higgs Motors, Witton, Birmingham

1. Mr. Walter F. Higgs, proprietor (*Lafayette*). 2. Mr. C. B. Crofts, chief engineer (*Whitlock and Sons*). 3. Mr. A. W. Fisher, London manager. 4. Mr. F. B. Holt, Manchester manager (*Elliott and Fry*). 5. Mr. G. B. Richards, assistant sales manager. 6. Mr. N. B. Thomas, accountant (*Philip Newman*). 7. Mr. S. J. Vaughton, sales manager (*Noëlfreda, Bristol*). 8. Mr. L. Bater, chief draughtsman (*Whitlock*). 9. Mr. J. A. Stokes, buyer. 10. Mr. F. Harrabin, assistant engineer (*Whitlock*). 11. Mr. H. T. Patchett, works superintendent (*Whitlock*).

The Open Mind. By C. Turnbull, M.I.E.E.

Another view

THE views expressed by "A. H. B." in the ELECTRICAL REVIEW appealing for an open mind on the part of electrical men concerning new inventions and indicating the need for a receptive attitude toward those who are responsible for the conception of new ideas have induced me to consider the subject from a somewhat different standpoint.

One might travel far without meeting anyone who would own up to being narrow-minded. Whatever faults we admit—and many people will frankly own up to some—we are all broad-minded, or we claim to be. Yet a glance round the engineering world may make us doubt.

At a recent exhibition in Olympia, our national pride was gratified at the sight of the fastest aeroplane, the fastest motor-car and the fastest motor-boat in the world, all British-made. Yet in the very fine machine tool section in another section of the Exhibition practically everything came from abroad. We have the brains to invent and make machine tools but those in control of the machine tool industry do not appear to have acquired that outlook which will make use of the ability which is waiting for an opportunity to exercise itself. The Diesel engine provides another example. It was invented by Akroyd-Stuart but it had to lie on the shelf until reintroduced from abroad under another name before it made its way, and to-day almost all Diesel marine engines made in Britain are from foreign designs. The same thing is happening with regard to new designs of ships' rudders, anti-rolling gyroscopes and new types of valve gears for reciprocating engines.

The Example of Hughes

Facing up to the problem does not make anyone popular; it seems an ungracious thing to criticise where so much splendid work is being done, but investigation is needful, and one way to approach it is through history and fortunately we have had two recent papers in the I.E.E. which provide first-hand information. In his delightful paper, Mr. Evershed tells us how Hughes did wonderful work in electricity. He invented telegraphic machines which our Post Office did not encourage; he invented the microphone to which no one at home paid much attention; and then he discovered wave telegraphy.

Mr. C. Turnbull is borough electrical engineer of Tynemouth

Full of enthusiasm he got together some learned men and told them all about it. But it is always difficult to arouse enthusiasm in learned men. They look for the possible errors and failings in the enthusiast, particularly if he is not one of the inner circle, and they are very careful not to give themselves away by encouraging a man who may turn out to be wrong. Had they known it, they were seeing the verification of Clerk Maxwell's theory, but they did not understand what they saw and they had not the open mind to say: "Continue your work which may lead you to something worth knowing!" Had they only done this, they would have gone down to history as benefactors of the world, and wireless telegraphy would have come into being sooner. As it was they froze Hughes out and sent him away feeling that he had made a fool of himself.

Heaviside's Unorthodoxy

After Hughes came Oliver Heaviside of whom Dr. Sumpner has given us an account. Heaviside was a kind of Alexander the Great. Alexander himself, tired of the long-winded mathematical proofs given by his tutors, asked for something shorter, to which he got the dignified answer that there is no royal road to learning. He was, however, justified in his impatience because mathematical proofs have been made much more suitable to royal and other minds since his days. In Heaviside's day, mathematicians were busy unravelling Gordian knots with meticulous accuracy, carefully picking their way from one point to another, and examining every strand of knowledge.

Heaviside presently came along with his keen sword and slashed through the knots, not at all in the way of the mathematicians. He did not conceal his contempt for some of their ways. Had you said to him that his methods were not derived from Cambridge, he would have replied, "Thank goodness, no!" When he came to deal with telegraphy he (I quote from memory) said that if love makes the world go round, induction makes telegraph currents flow.

This statement was about as bad as it could be to the experts of the day. First of all it was hardly proper for a mathematician to make use of such a simile, and then every expert knew that induction was the last thing you wanted in a telegraph cable. They were right if induction had been there by itself; but what they did not recognise was that induction may be a poison in itself, but it is an antidote to the other poison, capacity. Heaviside said that mathematics was the slave to physics and the slave must be trained to serve the master, not the kind of thing that the mathematicians were likely to approve of. Dr. Sumpner tells us all about it in his lecture which all engineers should read, mark, learn and inwardly digest.

Even yet Heaviside has not the position in England that his work deserves, and the electrical theory requires. Heaviside's methods are worthy of the most careful investigation and development. We have become accustomed to working out problems by a combination of experiment and mathematics; the lines of ships, the design of aeroplanes, propellers for both ships and planes, the flow of magnetic flux, and many other things are investigated by this combination. Geometry itself, now the most abstract of sciences, had an experimental beginning. Early mathematicians used to cut out curves in wood and weigh them to find out their areas.

In Advance of His Time

Heaviside developed the method to its logical conclusion, and combined the highest mathematical methods with physical intuition, thereby obtaining results beyond the reach of either experimenters or of mathematicians, although doubtless the same results will ultimately be arrived at in other ways. Dr. Sumpner records that Heaviside is not popular with mathematicians, which is much the same as if someone were to state that Sir Charles Parsons was not popular with engine-builders and that, now that he has gone, the steam turbine will be quietly dropped. The Open Mind is needed here.

Let me add another example. A workman in a large Tyneside factory brought out an ingenious tool which was put into use with excellent results. The man received no reward or encouragement, and probably brought out no further improvements. Had he been encouraged he would doubtless have followed up his first success with others.

These are three samples of what is happening on an immense scale in this country. We have inventors and ability but they have not the full and proper outlet for their energies. Anyone who goes round our modern factories must be struck with the fact that in machine tools we are not holding our place. We are too afraid of failure and sometimes forget that the man who never made a mistake never did anything original.

Sir Charles Parsons made many mistakes, but he won through in the end to great success. We need more of the spirit which he possessed in such abundance. Let us admit at once that it is hard for everyone to encourage the inventor who may be an outsider, in an inferior position, without reasonable power of expression, sometimes like Hughes telling his story incorrectly. But these men hold the key to future progress and, if we are to hold our own, we must find out some way for picking out the useful ideas, even at the risk of sometimes making a mistake.

D.C. Neutral Track Relays

THE second of a series of specifications in course of preparation dealing with railway signalling apparatus has now been published, this being the specification for tractive armature direct-current neutral track relays. In the past, the specifications in use by Colonial railway companies have been very largely based on American practice. In the preparation of a specification specially directed towards meeting both British and colonial conditions, the experience gained by manufacturers and users in connection with the well-known specification issued by the American Railway Association has been of great value, and in the course of its work the B.S.I. Committee has been in touch with the A.R.A. It is, therefore, confidently expected that the new British Standard Specification will rapidly become adopted by the British railways, and eventually by Colonial administrations. The specification provides for two grades of relay, one having a particularly high performance and the second grade corresponding very closely to the minimum requirements of the American specification. In addition to the electrical performance, certain mechanical features are dealt with.

Copies of the Specification (No. 452-1932) may be obtained from the Publications Dept., British Standards Institution, 28, Victoria Street, S.W.1, price 2s. 2d., post free.

E.H.P. Switchgear. By H. F. Yelland

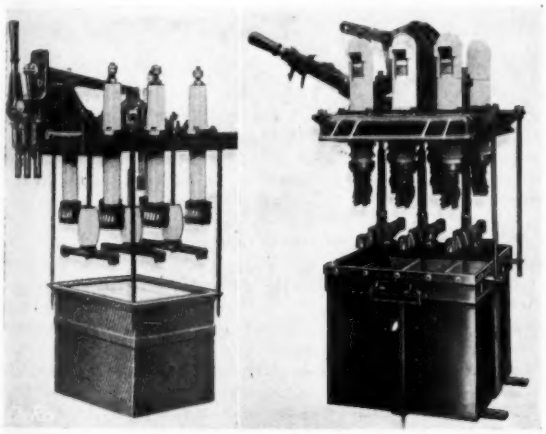
Points to be observed by the purchaser

A PURCHASER'S difficulties in selecting switchgear are due not only to the variety offered for any set purpose and the wide range of prices, but also to the impossibility of obtaining figures of efficiency, such as form the basis of comparison when buying other plant. That intangible asset, reputation, is thrown in when other things seem equal. Some investigation may be made into the question of reliability, but, since all manufacturers stand or fall on this last point, efficiency and price are really the predominating factors in the placing of a contract.

In comparing switchgear tenders in the absence of that data which forms a useful guide in the selection of other plant, the question of reliability looms large, and must eventually determine the placing of an order. By reliability we mean the ability of the apparatus to fulfil its assigned function, and with switchgear this means more than the ability of the switch or fuse to carry its rated current at rated voltage. It must operate without disturbance under the worst conceivable conditions on the circuit under consideration.

This is the fundamental point in switch design, a point not always appreciated by the purchaser, or even, in some cases, by the designer.

The worst condition which can arise is obviously a short circuit on the switch or fuse itself or close to its load terminals, with a minimum of impedance between it and the fault. From a knowledge of the plant capacity at the power



Two circuit breakers of equal rating but of contrasted design

station or feeder point and from details of the interconnections, cables, &c., the maximum kVA that the switch or fuse in question may be called upon to break can easily be determined and should be specified in an inquiry.

Types of Gear Available

The purchaser will probably invite tenders for switchgear to deal with a specified load at a specified voltage, and, if the data are available, of a specific rupturing capacity. The appropriate British Standard Specification should be quoted in his specification so that all tenderers may be on a level footing.

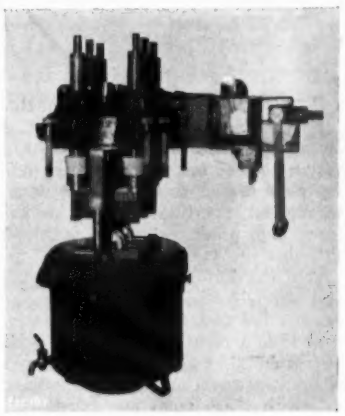
With regard to e.h.p. gear his choice is limited to two main types, the metal-clad and cubicle types, which have been developed in the following different forms set out in progressive price order:—(i) Stationary non-interlocked sheet steel cubicles; (ii) metal-enclosed vertical or horizontal isolation (air insulated "space-saving" gear); (iii) stationary sheet-steel interlocked cubicles; (iv) truck-type gear (horizontal isolation); and (v) compound-filled or oil-filled horizontal draw-out or vertical drop-down type.

Each class has its own sub-divisions varying with degrees of interlocking, material for insulation of conductors (*i.e.*, solid compound, semi-fluid compound, or oil), or methods of isolation by plugs or switches; there are also hybrid types, such as cubicles with compound-filled busbars or fixed metal-clad gear with coupled isolators. Site conditions may in some degree influence the choice.

Design Considerations

The primary consideration must be whether the circuit breaker is capable of its assigned duty. It has not been possible so far to draw up a standard design to have a definite rupturing capacity, so that, although a circuit breaker may be required to comply with B.S.S. No. 116, the articles offered may differ in construction to a bewildering extent, due to competition in design and price. The engineering standards and dimensions and the specified tests may be complied with, but still the difference exists, so that at this point technical considerations enter into play to determine the selection. A set of technical data may be obtained from all manufacturers, but it is likely to give a wrong picture.

The data usually furnished concerns the head of oil above the break, the speed of break, the quantity of oil in the tank, the thickness of the tank, and so on, but, without a clear picture of what happens under fault conditions, this information can be of little use except to the switchgear specialist.



A modern switch of high rupturing capacity

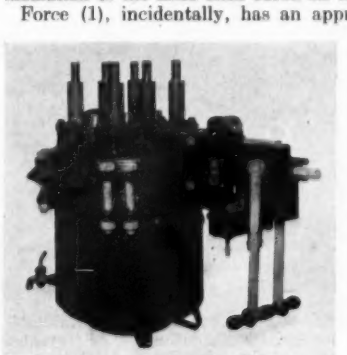
When a circuit breaker opens on a severe fault it is subject to heavy stresses. These stresses are a combination of electro-mechanical forces due to the fault current, electro-pneumatic forces due to the formation of an arc in the oil, and thermal stresses due to the abnormally high current densities in certain parts. Electrostatic stresses have also to be taken into consideration.

Electro-mechanical Stresses

Electro-mechanical stresses may be resolved into three components: (1) The force acting upon the moving blade of the circuit breaker; (2) the force acting between poles tending to open out the conductors in the form of a loop; and (3) the forces of attraction and repulsion between conductors and associated equipment. To resist force (1) parts of the lifting and tripping mechanism must be stronger than would be necessary for purely mechanical reasons; particular attention must also be paid to the method of insulating the moving blade from the mechanism. The weakest form of construction is one in which a porcelain insulator in tension is introduced between the mechanism and switch blade with metal inserts in each end, and switch blades of this type have been blown off under fault conditions and found later in the bottom of the tank.

Another weakness of this type lies in the difficulty of fixing the metal parts in porcelain. Special cements may soften in the oil and lead fixings are not always satisfactory, so that the switch blades often pull out in normal usage and lose contact pressure. A better construction is obtained by the use of "Bakelised" wood or its equivalent between the switch blades and mechanism, or by the use of a substantial clamp around insulation of the mica class cured on to the blades.

Force (1), incidentally, has an appreciable effect upon the speed of break, and since high speeds may be obtained a consideration of the shock-absorbing device is advisable. A circuit breaker may also be subjected to heavy through currents, due to faults on a distant feeder which would not trip it but which would be cleared on a distant breaker. The momentary forces exerted upon the cross bar of the circuit breaker carrying the through current tend to separate the fixed and moving contacts, so that unless the mechanism is sufficiently rigid the tendency would be for the contacts to move slightly apart and weld together.



A h.p. switch embodying features recommended by the author

Force (2) acts between the conductors on the same pole tending to thrust them apart, and the stronger the insulators supporting them the better. In weighing up the merits of the various constructions, the material of the insulators, the length of the unsupported insulation, and the cantilever forces acting at the end should be borne in mind. Porcelain or wrapped bushings are usually adopted for this purpose; while the porcelain insulator may appear from a consideration of bending stresses to have a greater strength, the wrapped bush-

ing derives assistance from the conductor, which is not so certain where the conductor is fixed to a porcelain insulator only at the extreme ends.

Force 3 has much the same effect as Force 2, and the strength of the insulators is the best criterion of the merits of the design. In both cases the method of fixing the insulators to the top plate should be noted, and credit given for the best construction. The forces acting upon the fixed insulators act almost equally upon the moving blades, and a design in which the three blades of a three-phase circuit breaker are braced together by suitable insulation is to be preferred to one without, providing that other features have not been weakened by this addition.

Electro-pneumatic Forces

Electro-pneumatic forces are set up by the action of the arc in oil. The first effect, as the arc is drawn, is a rapid surging of the oil, which may be driven upwards against the top plate of the circuit breaker with great force, and ejected through any apertures. As the arc tends to expand in spherical form, high pressures are exerted upon the tank walls, tending to bulge the tank.

The best form of top plate to resist these forces is domed and strongly reinforced. In assessing the merits of two designs the material of these frames, their shape and thickness should be considered. A flat cast-iron plate may easily be fractured, especially along the axis between the poles, where it is weakened by holes for the operating rods. A design in which these holes are dispensed with and the operating mechanism kept beneath the top plate is preferable. The best venting arrangements ensure a rapid cooling of the expelled gases and prevent oil ejection. The methods adopted for joining the top of the tank to the frame should prevent the expulsion of oil through the joint.

The relative merits of round tanks and rectangular tanks used to be a controversial matter, but it seems that while for equal thickness of material a round tank may be the stronger, a square tank can be thickened or provided with suitable reinforcement. Study then the construction of the tank, its thickness, its reinforcement, and its lining. Study also the tank-fixing arrangements, the construction of the tank bolts, their size and number, and give marks accordingly. Remember that a short sturdy bolt will suffer less elongation than a long bolt for a given sectional area.

Thermal Stresses

Thermal stress ranks equal in importance to those stresses described above. It may be sub-divided into the stress due to the rapid rise in temperature at the main and arcing contacts as the switch opens, and that due to the tendency of the conductors to distortion. The first stress is minimised by the use of massive arcing contacts, the object of which is to keep the temperature at the root of the arc to a minimum; most credit must be given to the design incorporating massive and easily removable contacts. Some otherwise excellent designs might be condemned owing to the use of flimsy arcing contacts obviously unfit to carry the short-circuit current.

To prevent distortion due to thermal stresses the conductors have to be of sufficient sectional area to withstand the heavy peak currents of the circuit. The circuit breaker rated at 150,000 kVA for use on an 11-kV three-phase system may be called upon to withstand an asymmetrical peak current of 31,000 A. If the circuit breaker had a current rating of 200 A it would be permissible under B.S.I. ratings to use a stem of ¼ in. diameter, but such a stem might suffer permanent distortion at low-peak current values, and the stems must often be considerably larger than normally required.

Two circuit breakers of equal rating are shown in the first illustration. Manufacturers A and B both claim a breaking capacity of 75,000 kVA; the current rating is given as 200 A, and the system voltage 11 kV. Having decided which is the more suitable for its duty the reader will be able to appreciate the finer points of design shown in the other figures, the last of which shows a breaker of much higher rupturing capacity.

Current Transformers

For reliability, ring-type current transformers are to be preferred to transformers with wound-primary conductors, but at present they are available at economic prices only for primary load currents of 100 A and upwards. If a sensitive circuit-breaker trip mechanism and ammeters (if necessary), both of low VA consumption, are provided, ring-type transformers should be used to give plain overload protection and indication. Where primary-load currents are so small as to make imperative the use of wound-primary current transformers, the buyer should study their capacity to withstand short circuits, having regard to the rupturing capacity of the switchgear, as there is no guide to this in standard specifications, which only lay down the requisite degree of accuracy. A nice balance has to be struck to satisfy the conditions of accuracy and ability to withstand heavy short circuits at reasonable cost.

Current transformers are subject to failure from three main causes: (1) weak mechanical construction; (2) low thermal capacity; and (3) failure of insulation.

Fault 1 is due to insufficient bracing of the conductors to withstand the forces tending to open the conductors out in the form of a loop.

Fault 2 is brought about by the use of a primary conductor too small for the fault current. A commercial current transformer will withstand for a period of half a second a current approaching 100 times its full-load primary rating, so that one having a ratio of 50/5 A will withstand for half a second a current of 5,000 A. At 11 kV on a three-phase system this gives a short-circuit value of 95,000 kVA, and this transformer is unsuitable where switchgear of 250,000-kVA rupturing capacity is necessary.

Busbars and Connections

The abnormal stresses in busbars and connections are mechanical forces of attraction and repulsion between conductors, and thermal stresses. Suitable bracing of conductors is requisite to meet the first point, and sufficient sectional area of conductors to meet the second. Give most credit to the well-braced structure and least to unsupported connections of small diameter on a high breaking capacity equipment.

The art of circuit breaking and circuit making is not an exact science, but sufficient data exists to enable manufacturers to provide with reasonable accuracy a design to perform a given duty cycle.

Starting from a knowledge of the rupturing capacity required, the system voltage, and normal current to be dealt with, the various stresses can be easily determined as the design proceeds, and safety factors introduced accordingly, so that the design follows normal mechanical constructions in which the strength of materials is known and checked.

It is only because the average switchgear buyer has a difficulty in analysing design that the manufacturer of overrated switchgear "gets away with it," and if the foregoing remarks have helped to clear the fog surrounding switchgear design, they may also have helped to put an end to unjust trading, on the basis that "it may never happen."

I am indebted to Messrs. Johnson & Phillips, Ltd., for permission to use the photographs of the last two switches illustrated.

The "Talkatome"

A PRIVATE demonstration of the talking-film outfit which is being marketed by British Talkatome, Ltd., created a very favourable impression of the capabilities of the equipment.

The projector, one of several available makes, accommodates 16 mm. "Non-flam" film (24 frames per second). The driving motor also operates the turntable, through a flexible shaft, at 33⅓ r.p.m. The electrical pick-up traverses the 16-inch sound-record disc outward from the centre, and a small lamp with a partly obscured globe facilitates the changing of records in a room darkened for projection. On the front of the turntable case besides the connecting plugs and switch are a volume controller and tone adjuster that moderates the higher frequencies to produce the more mellow tone which some listeners prefer.

Synchronisation is quite good and not difficult to achieve. The disc and film are each appropriately marked with a broad arrow. Providing the two arrows point at the starting notches, all one has to do is to switch on the driving motor, which simultaneously starts both projector and turntable.

The valve amplifier, which forms part of the equipment, and the portable screen, which incorporates a moving-coil loud speaker, are not essential for users who possess radio reproducers.

For ordinary domestic use with the projector and screen about 15 ft. apart the pictures completely fill a screen about 3 ft. high by 4 ft. wide, which suffices for normal requirements in the usual size of sitting room. The time occupied in projecting 400 ft. of 16 mm. film, which is the equivalent of 1,000 ft. of standard 35 mm. "talkie" film, is between 12 and 15 minutes. The whole of the dialogue and sound for that length of film is recorded on one side only of a 16-inch disc.

The company has formed a library of films with their accompanying sound discs which can be hired by subscribers. Apart from home entertainment, this apparatus should have a useful sphere of application for instructional and educational purposes.

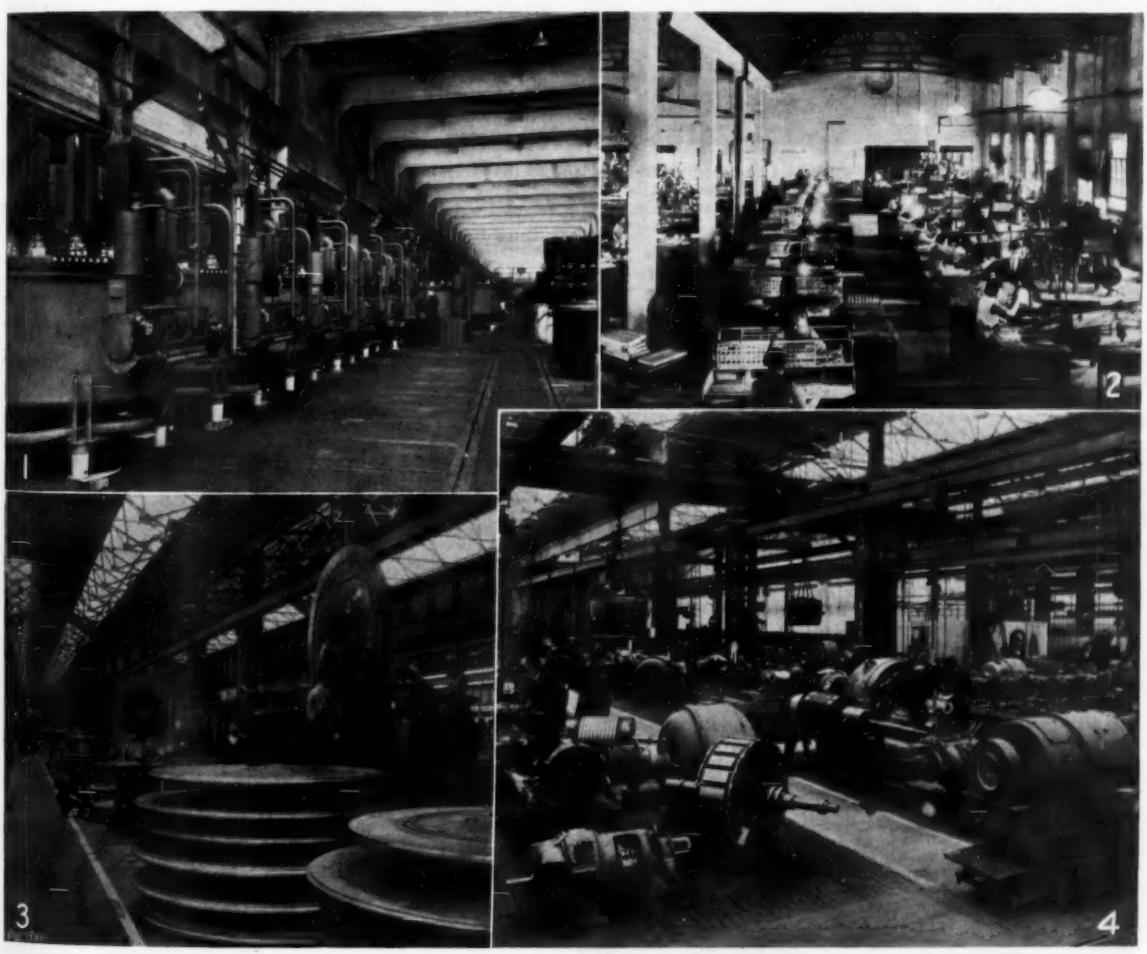
Institution Members at Rugby

The I.E.E. Meter and Instrument Section visits B.T.-H. works

TRAVELLING by rail and road, some 170 members of the Meter and Instrument Section of the Institution of Electrical Engineers, with their ladies and friends, assembled in Rugby on Saturday, May 7th, for their annual outing. The day was fine and the visit so organised as to afford an opportunity of gauging the diversity of the products of the British Thomson-Houston Co.'s works.

The tour commenced in the Engineering Laboratory, where developments were noted in connection with new types of valves and mercury-vapour rectifier valves; high-frequency heaters; radio interference with motors and other apparatus; electric clocks; electric furnaces; photo-electric and selenium cells; "Silundum" heating elements for fires and furnaces; and ultra-violet, mercury-vapour, and metal-arc lamps. General research work is being carried out on insulating materials and compounds, including synthetic resins and synthetic moulding powders, and in a special process laboratory insulating processes and treatments are investigated and materials tested under tropical conditions.

In another section of the Laboratory the mechanical properties of insulating materials are being investigated and high-voltage tests carried out. A television equipment is used in connection with experimental work. Another interesting piece of apparatus which is being developed is a 100,000-V compressed gas condenser for a power factor testing equipment.



The B.T.-H. Company's Rugby Works

1. Mercury-arc rectifiers assembled for test. 2. Making stems and mounts for "Mazda" lamps. 3. Blading section of turbine factory. 4. General view of motor factory.

In the acoustical theatre demonstrations were given of sound reproducers for speech and music, and B.T.-H. talking film equipments, such as are in use in over 700 British cinemas.

Lamps and Washing Machines

An example of intensive mass production is the "Mazda" lamp factory, where complicated operations are carried out by machines at extremely high speed. This section of the works was fully occupied, even on Saturday morning. For the vacuum and gasfilled lamps made each year at Rugby, approximately 10,000 miles of tungsten wire is used for the filaments.

"All-British" electric washing and ironing machines are made by the B.T.-H. Co. for the Hotpoint Electric Appliance Co., in a factory equipped with modern machine tools so laid out as to ensure rapid manufacture, and assembly, painting, and final testing are effected on a continuous conveyor system.

From these representative examples of the smaller B.T.-H. apparatus attention was diverted to the large plant. For example, in the turbine factory the machines at present in process of manufacture include, besides several of smaller size, the two 75,000-kW turbo-alternators for the new Barking extension of the County of London Electric Supply Co. These are claimed to be the largest turbo-alternators yet ordered in this country.

On the point of despatch are six turbine-driven gas boosters for a new booster house at the Beckton gas works of the Gas Light and Coke Co. Three of these machines have a capacity of 3,000,000 cu. ft. and three of 2,000,000 cu. ft. per hour. In all cases the suction is 1 in. water gauge and the delivery pressure 21 in. water gauge.

In the large electrical machine shop which, like the turbine factory, is 1,000 ft. long with side bays and galleries, are manufactured electric motors, generators, rotary convertors, motor convertors, motor generators, mercury-arc rectifiers, and transformers.

Railway Rectifiers

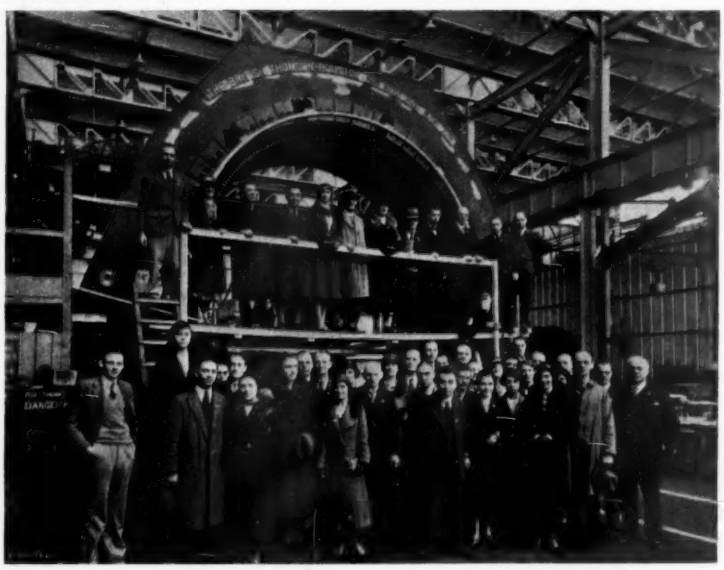
Rectifiers for the L.M.S. Railway (Barking-Upminster electrification) have recently been despatched and at the present time rectifiers are being manufactured for the London and North Eastern and London Electric Railway Companies. The rectifiers for the London Electric Railway are to be installed in the additional sub-stations required in connection with the extension of the Piccadilly Railway from Finsbury Park to Cockfosters and the "stiffening up" of the traffic on the District Railway.

The decision of the London Electric Railway Co. to purchase the entire sub-station equipment from British firms was reached after trial equipment, said to be the first to be designed and manufactured in this country, had given satisfactory service in the Hendon sub-station. This trial equipment was supplied by the B.T.-H. Co., which received the contract for the whole of the plant required for the Cockfosters extension,

together with that for two sub-stations on the District Railway. For these sub-stations twenty-two rectifiers were ordered, seventeen being of 1,500-kW and five of 2,000-kW capacity. These machines will be installed in four three-unit and five two-unit sub-stations, all of which will be unattended and controlled from central control rooms at Earl's Court and Wood Green.

Water Power and Grid Plant

There are at present under construction two large water-wheel alternators for the Grampian Electricity Supply Co.'s Tummel power station. Each of the machines comprises a horizontal duct-ventilated type alternator having a rating of 21,250 kVA at 80 per cent. power factor, 300 r.p.m., 11,000/13,000 V, 50 cycles, three-phase. When completed, the total weight of each machine will be approximately 200 tons. There are also in course of manufacture two 2,500-kVA water-wheel alternators for the East African Power and Lighting Co., Ltd. (Maragua development scheme).



The visitors grouped in front of one of the Grampian Scheme stators

Among transformers in process of manufacture those for use in connection with the grid vary in output from 60,000 kVA at 132,000 V to 2,000 kVA at 33,000 V. The coils for the 60,000-kVA transformers are notable for their large diameter, the length of the transformers being definitely limited by the available transport facilities. All B.T.-H. transformer coils are wound on heavy cylinders of treated paper so as to give a firm mechanical foundation. "On-load" tap-changing equipment for the large higher-voltage transformers is of the double ratio adjuster type, and for the small medium-voltage transformers it is of the drum controller type.

Fabrication by Welding

The progress of fabricating steel structures to replace iron castings is most noticeable. This method of construction is now applied to baseplates, machine frames, bearing housings, rotor spiders and flanges for many types of machines, brushgear supports, various kinds of covers, tanks for transformers and mercury-arc rectifiers. The mild steel plates are flame cut, rolled, shaped, and electrically welded to almost any design. A particularly interesting fabricated structure is at present in the turbine factory, being a stator frame for one of the 75,000-kW turbo-alternators for Barking.

The fabricated method of construction is used in some form in connection with almost all electrical equipment and enters largely into the construction of some of the industrial motors manufactured in the Rugby works. The well-known B.T.-H. "No-Lag" power factor correcting motor is as easy to operate as an ordinary slip-ring induction motor and is started in the same way as the induction motor. Moreover, it has as great a starting torque. With slight modifications, motors of this type can be designed to run at any fixed speed, or at a number of different fixed speeds, between normal synchronous speeds. Thus, although 50-cycle speeds of 1,200 or 800 r.p.m. are not possible with ordinary induction motors, they can readily be obtained with "No-Lag" motors.

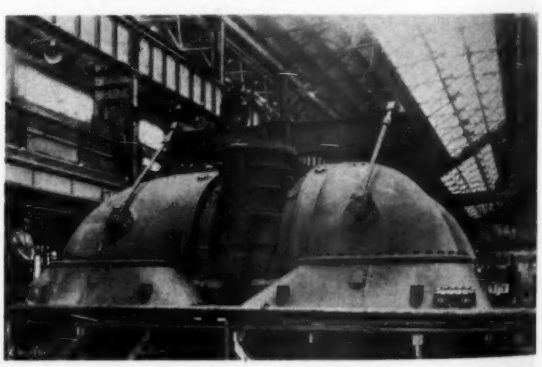
Fabricated stator frame of one of the 75,000-kW Barking alternators

The B.T.-H. variable speed, shunt characteristic, commutator motor for polyphase circuits was first put on the market in 1916 and since that date motors with a total output of over 50,000 h.p. have been supplied for numerous industrial purposes, such as driving paper-making machinery, printing presses, machine tools, lifts, textile machinery, air compressors, hydraulic pumps, fans, chain grate stokers, &c.

Other interesting items which were inspected were "unbreakable" grid resistances, which will withstand severe conditions of service aboard ship, for traction, and industrial service, especially for cranes, haulages, steel works, &c., where vibration and exposure to the elements tend to shorten the life of the more fragile cast grid types. The elements consist of a continuous length of strip or wire formed into grids on patented machinery. There are no joints in a complete resistance unit or tier unless it is essential to change the section of the strip. All the assembly work is carried out on a continuous conveyor system.

Hillmorton Visited

After luncheon in the works canteen [Mr. H. N. Sporborg, director and chief engineer, Mr. A. P. Young, works manager, and Mr. F. C. Knowles, chairman of the I.E.E. Meter Section, were the speakers] three motor coaches conveyed the visitors to the Government wireless telegraph-telephone transmitting station at Hillmorton.



H.p. cylinder of one of the 75,000-kW Barking sets

Lieut.-Col. A. S. Angwin acted as host on behalf of the G.P.O. at tea and the whole of the long- and short-wave equipments was inspected; some of the younger ladies even braved the ascent of an 820-ft. aerial mast.

British Standards for Copper

Two new British Standard Specifications for copper deal, respectively, with plain dead-soft copper strip, bars and rods for the windings of electrical machines (No. 444-1932) and copper commutator bars for electrical purposes (No. 445-1932). Both specifications include requirements for conductivity and tensile properties, whilst in the case of the commutator bars Brinell hardness tests and Shore sclerescope tests are given for application at the option of the purchaser. The selection and preparation of samples for the electrical and mechanical tests are dealt with and clauses relating to testing procedure are included. The Specifications do not standardise sizes for the bars, rod and strip, but tolerances on width and thickness, and in the case of commutator bar strength and angle also, to apply to the nominal sizes ordered by the purchaser, are specified.

Copies of these specifications may be obtained from the Publications Department, British Standards Institution, 28, Victoria Street, S.W.1, price 2s. 2d., each post free.

The Modern Frequency Meter

Steps in its evolution

THE first reliable frequency meter was the tuned reed pattern, due originally to Professor Ayrton. The constancy of these instruments was remarkable—all the more so in view of the fact that accuracy depends upon the elasticity of the steel and that at 50 cycles per second the reed makes more than 8½ million complete swings every day and yet, after years of use, it is rare to find a change of more than 1/10th cycle from the original value. At the same time, the reeds are not easy to tune accurately, and it must be admitted that the scale is difficult to read, a certain amount of guesswork being always involved owing to the limited number of reeds.

Although, on modern supply systems, the mean frequency is commonly "time controlled" to within a few seconds per day (or, in other words, to within a few parts in 100,000), it is essential for the control engineer to know the momentary frequency and if possible to obtain a permanent graphic record, to ensure that the mean frequency is not maintained at the cost of wide variations during the day. When this requirement first became evident there was no instrument suitable for the purpose. For the reasons already given, the vibrating reed instrument was useless and the best deflectional pattern then available had not anything like the accuracy required.

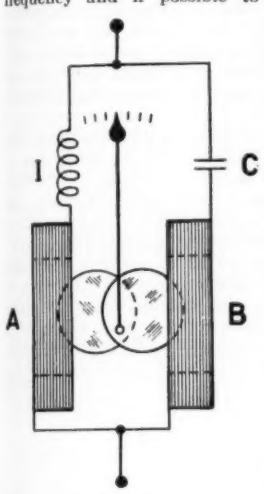


Fig. 1

Difficulties to be Overcome

Eighteen months ago Messrs. Everett, Edgcumbe & Co., who were the pioneers in advocating the time control of frequency in this country, set themselves to solve this problem. A reference to fig. 1 will indicate the difficulties which had to be overcome. This figure gives the operating principle of a typical deflectional frequency meter of that date. A and B are two windings acting differentially upon the moving element, which takes up a position dependent on the ratio of the currents in these two coils. The one is fed through a condenser C and the other through an inductor I, with the result that, if the frequency increases, the current through the condenser C is augmented and that through the inductor I is diminished, so that the pointer deflects towards the right and *vice-versa*.

The indications of such an instrument, whilst reasonably independent of changes of voltage (since these affect both windings equally) are very dependent upon the wave-form of the supply. This will be evident when it is remembered that the current flowing into a condenser is three times as great for a triple-frequency component in the voltage wave as for the fundamental, and similarly with other harmonics. A corresponding reduction is suffered by the current in the inductive circuit, and altogether the errors introduced are much too great to be tolerated in modern practice.

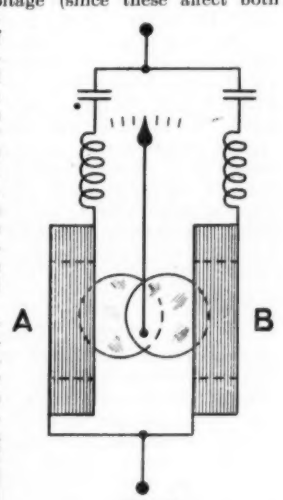


Fig. 2

Moreover, with such instruments, the current in one winding is proportional to the frequency, and that in the other inversely proportional to the frequency, so that the instrument is not capable of giving a very "open" scale, a range of 45-55 cycles per second being about as wide a range as can normally be given. This is not in any way a question of the nature of the movement, no other form, such as the induction or the electro-dynamic, being more satisfactory—in fact, rather the reverse, owing to the increased power consumption which attends their use.

For present-day control-room requirements any readings beyond, perhaps, 2 cycles per second on either side of the normal are of no interest, so that a scale of 49-51 cycles per second for an indicating instrument, or 48-52 cycles per second for a graphic instrument, is probably the best. Such scales are readily obtained by the use of resonant electric circuits, as embodied in the Everett-Edgcumbe precision frequency meters, first exhibited at the Physical Society's Exhibition a year ago.

Fig. 2 shows the internal connections of this instrument, from which it will be seen that, instead of one coil being connected through a condenser and the other through an inductor, each embodies a combination of capacitance and inductance connected in series. Each circuit is tuned to a different frequency, the one above and the other below the normal frequency of the circuit.

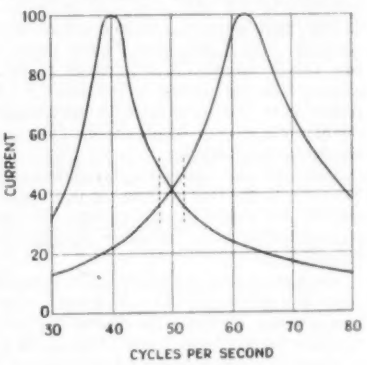


Fig. 3

The value of the current flowing in each of these windings in a typical case is shown approximately in fig. 3. One curve shows the current which flows through coil A at a given voltage and at various frequencies, and similarly for coil B. The two vertical dotted lines correspond to frequencies of 48 and 52 cycles per second respectively, *i.e.*, the lowest and highest points on the scale. It will be seen how great is the increase of current in coil B and the corresponding reduction of current in coil A for this very small change of frequency.

Importance of Wave Form

It is also possible by careful design to eliminate errors due to distorted wave forms. As already pointed out, the current in a purely reactive circuit varies almost in proportion to the frequency, directly or inversely as the case may be. With a tuned circuit, however, the conditions are entirely different. As shown in Fig. 3, the current increases to a maximum value at the resonant frequency and then rapidly falls away as the frequency changes in either direction. So long, therefore, as the resonant frequency is not far removed from the normal frequency of the system—to avoid possibility of resonance with a harmonic—the current flowing in either circuit due to a third, fifth, seventh, or other harmonic will be very small.

The current will not, however, be zero, and the skill of the designer shows itself largely in the extent to which he so proportions the characteristics of the various circuits as to render negligible the effect of harmonics upon the ratio of the currents in the two coils, upon which ratio alone depends the deflection of the pointer.

The question of the effect of a bad wave-form on the reading of a frequency meter is a matter of considerable importance, since although the wave-form of a modern public supply is normally excellent, occasions arise from time to time, particularly at periods of light load, when the wave-form is badly distorted, and unless the frequency meter is immune from disturbance serious misunderstandings can arise.

Effects of Voltage Variation

Another important question is the effect of changes of voltage upon the readings. A glance at the connections given in fig. 2 will show that a rise or fall of voltage must affect the current in both circuits equally and so should be without effect on the readings. In practice, it is found that a change of ±15% cannot be detected in the deflection. Station engineers may ask, however, what would be the effect of a very serious drop, say down to a third or half of normal voltage, owing to fault conditions. Tests show that at half-voltage the reading is still correct to within 1/10th cycle per second.

The same principles are applicable to the construction of graphic frequency meters, by means of which a continuous and permanent record of the frequency is obtained. A usual range for such instruments is, as has been said, 49-51 cycles per second, the chart being a perfectly evenly divided one with the 50-cycle-per-second point in the centre.

The chart of the "Inkwell" graphic frequency meter is 4 in. wide and thus gives a deflection of 1 in. for each half cycle per second. Each cycle is divided into 20 divisions, representing 0.05 cycle per division (1/10th in. in length) so that a change of frequency as small as 1/50th cycle per second can readily be seen on the chart.

An important improvement recently introduced by Messrs. Everett, Edgcumbe, and applicable not only to graphic frequency meters but to all their "Inkwell" instruments, is the adoption of a non-expansible paper for the charts. The paper upon which the majority of such charts is printed is very susceptible to damp; in fact, an ordinary chart may differ as much as 1/5th in. between a dry day and a damp day, corresponding to an error of 5 per cent. in the record at full scale. In the paper used for the Everett-Edgcumbe charts the expansion and contraction are so small that the error which would be introduced under similar conditions in the reading at 50 cycles amounts to less than 0.02 per cent.

The inaccuracy introduced in the timing and in the indications by the expansion of the chart through humidity has long presented a serious difficulty, and its elimination from the "Inkwell" grapher represents a very important advance.

Brazing Metals with Silver Solders. By A. J. T. Eyles

How to obtain the best results

THE art of brazing metals with modern silver solders is to-day extensively employed for joining metal parts when greater strength is required than can be obtained by soft soldering, or when the parts have to withstand a temperature that would cause soft solder to fuse. Silver soldering is also used when the high temperature developed by welding methods would seriously distort parts adjacent to those that are being joined. Components made of brass, bronze, or copper can be joined so effectively by brazing with silver solder that the joint will be approximately as strong as the component itself. Another valuable characteristic is its high electrical conductivity.

Although the alloys employed are called silver solders their function is that of a brazing medium, as they are generally applied by means of an atmospheric coal gas blowpipe flame, oxy-acetylene flame, or other brazing appliance of the Bunsen-burner type.

The strength of the silver-solder brazed joints depends largely upon the nature of the solder used, the temperature at which the brazing is done, the thoroughness with which the components to be joined are cleaned, the correct manipulation of the blowpipe flame, and the proper use of suitable fluxes. The fundamental advantage of silver solder for electrical work is the freedom with which it will melt and flow into joints to form a close, neat joint, the strength and reliability of which exceeds that obtained by either soft soldering or spelter brazing.

Silver Solder Economical to Use

Unfortunately, many manufacturing firms associate high cost with the name of silver solder; but, owing to their quick and free-flowing properties, the careful and sparing way in which they can be used, and the fact that joints require little finishing, silver solders are economical to use. In fact, they are actually the cheapest jointing materials to employ for many types of joints. They have superior strength; make neat, ductile, and permanent joints resistant to bending stresses, shock, vibration, corrosion; and have relatively high

Elastic web weaving at the Borrowash (Notts) mill of Messrs. Faire Bros. & Co. An avenue between two rows of looms with driving motors mounted overhead on frame bridges

operating temperatures. In addition, some silver solders have relatively high electrical conductivity.

Silver solders are made in sheet, strip, wire and granular form, and in a number of different grades of fusibility. The melting points of silver solders vary between 1,250 and 1,600 deg. F. The melting point of pure silver is 1,761 deg. F., but this is lowered by the addition of copper, zinc, and sometimes cadmium. The solders contain a high percentage of copper, which may be considered as the base metal of the solder, since the melting point is higher than that of silver. In general, the solders containing high percentages of silver flow at the lower temperatures, though this is not always true, as the low melting point may be obtained by increased proportions of cadmium and zinc.

Specifications for silver solders of a fairly high silver content have been drawn up by the British Standards Institution (Report No. 206/1924), their approximate silver content being for grade A 61 per cent., and for grade B 43 per cent.

The range of melting point should be selected according to the metal which it is intended to join, but, since the melting point is not a complete guarantee of quality, the recommendations of the manufacturer also should be considered. It is often important, also, that the colour of the silver solder should match the colour of the metal parts, especially if they are made of monel metal, nickel, nickel silver, stainless steel, or silver.

Preparing Joints

Too much care cannot be taken in preparing the metal surfaces to be joined. Although a good flux will dissolve films of oxide during the brazing operation, it is necessary to start with perfectly clean joints. Various methods of cleaning may be employed, such as filing, scraping, grinding, etc. If the metal parts are greasy they should be immersed in a hot alkali solution to remove all trace of grease or oil.

The joints should be fairly smooth and they should fit closely. The component parts should be held together firmly while the brazing operation is being performed. Silver solder is remarkably fluid when in a molten state and penetrates interstices which ordinary brazing spelter would fail to fill. Only a film of silver solder is necessary to form a strong and sound joint. It is wasteful to use the solder as a filling-in material.

In order to protect the metal surfaces against oxidation and to assist in the free flowing of the silver solder a flux is essential. Although there are a number of good brazing fluxes on the market, calcined borax or a combination of borax and boracic acid will meet most requirements. The borax is generally more satisfactory when used in the following ways: (1) Dissolve borax in clean hot water to make a saturated solution; keep the solution hot while using as the borax is then more evenly deposited. (2) Mix powdered borax in clean water to make a paste approximating the consistency of a fairly thick cream. (3) Mix calcined borax with alcohol. This flux must be kept in a closed container to prevent evaporation when not in use.

Temperature for Brazing

It is important to remember that not only must the proper temperature be employed, but the required amount of heat must also be supplied. The metals to be brazed should be properly preheated at the joint and adjacent areas. This can be accomplished by the use of a blowpipe flame. If expertly manipulated, an oxy-acetylene blowpipe can be used with success. The flame is intense, however, and must be kept in motion during the brazing operation. For most electrical work oxygen and gas or an air-coal gas blowpipe flame will give good results.

Great care should be taken not to overheat the metal parts. When sufficient preheat has been applied to the joint, the flame should be moved away and the silver solder brought to the joint, where it will melt and flow quickly if the parts have been properly fluxed and preheated. The heat should be continued only long enough to cause the silver solder to flow freely. Prolonged heating must be avoided, as it tends to oxidise and weaken the silver solder and the metal. Balling or bunching of the flux usually indicates improper fluxing, or may be due to insufficient heating.

While silver brazing requires skill, it is not difficult to accomplish if proper attention is given to the heating of the joint and the right flux is used. For instance, many manufacturing firms employ girls for silver-brazing components. Silver leads all metals as a conductor of electricity, particularly those compositions having a high percentage of silver, and as a result these silver solders have proved to be very satisfactory for electrical work.

Use in Electrical Work

Leading manufacturers of silver solders have standardised their compositions to a point at which users of their solders have definite and uniform electrical characteristics to work with. Silver solders have been successfully used by manufacturers of delicate X-ray equipment, electrical transformers, generators, motors, electric heaters, telephone switchboards, and a great many instruments and devices in which the electrical conductivity of the silver brazed joint is as important as strength and ready workability.

In conclusion, it may be of interest briefly to mention the serviceability of silver solder for emergency repairs. A large electrical manufacturing company experienced a breakdown of one of its 1,440-h.p. 2,300-V 514-r.p.m. 3-phase synchronous motors. When repairing the motor difficulty was experienced in brazing the copper cross-bars to the hard-drawn copper retainer rings. All kinds of brazing spelters and silvers were tried without success. The job was finally accomplished by using special silver solder, and the electrical firm has since adopted silver brazing as standard practice for similar repair jobs throughout its system.

Motor Control and Power Factor.

By D. Dyson Rayner, A.M.I.E.E.

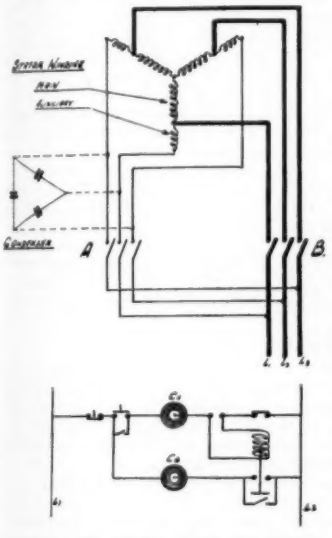
The use of an auxiliary winding in conjunction with condensers

THE star-delta method of starting three-phase squirrel-cage induction motors is in general use where limitations are imposed on the starting current, but in common with all types of starters involving the use of a change-over switch it has the disadvantage that at the moment of changing from "star" (start) to "delta" (run), the motor is temporarily disconnected from the lines.

If the change is not carried out at the correct moment, severe mechanical stress may be incurred, accompanied by a violent current fluctuation and consequent line disturbance; in addition, the loss of power during the change-over period makes the method prohibitive in certain cases.

In order to overcome this drawback, and yet maintain simple and efficient control gear, the following method, requiring straight-on type starting switches only, has been devised.

The main stator winding of the motor is arranged for operation in star instead of in delta; an auxiliary winding, connected in series with the main winding, has the number of turns necessary to make the total number in both windings produce the same flux as that produced with a "delta" winding when connected "star" directly across the source of supply.



Above: Connections for squirrel-cage motor. Below: Wiring for push-button control

Better Starting Conditions

To start the motor, the main supply is connected directly across the two windings in series. After a time interval, during which the motor accelerates, the supply is connected across the main winding, and the auxiliary winding is then disconnected immediately, the motor operating under normal conditions.

The starting conditions are thus similar to those obtaining with the star-delta method, with the advantage that the motor is never disconnected from the line between "start" and "run" positions. As the auxiliary winding is only in circuit for a short period, it can be designed for a higher current density than the main winding, and so entails little additional space in the stator slots.

As an example, a standard 8-h.p., 710-r.p.m., squirrel-cage induction motor, arranged for star-delta starting, has the torque/speed curve shown in the accompanying diagram, which indicates the violent fluctuation in the torque when changing over from "star" to "delta." The stator of this machine was wound with fifty-six conductors per slot for normal operation with the winding connected in "delta."

A similar frame was provided with a main winding having thirty-two conductors per slot, arranged for operation in "star" connection, so the working flux is the same as in the standard machine. An auxiliary winding was added having twenty-four conductors per slot, *i.e.*, the difference between the number of conductors required for a "delta" and "star" winding, and disposed around the stator periphery so as to have identical phase relationship.

A Contactor Arrangement

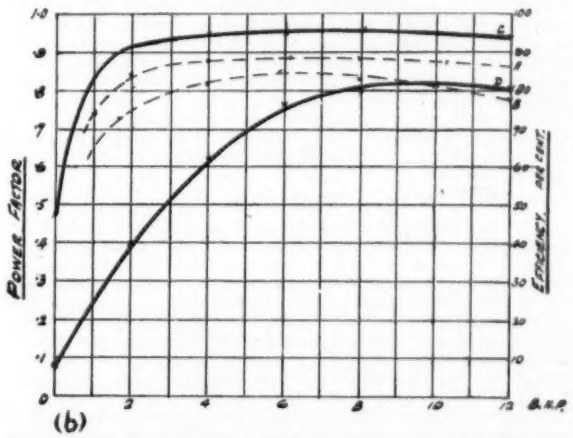
The starting gear comprised two triple-pole contactors with a timing relay. When starting up, contactor A closes first, and after an adjustable time interval, contactor B closes, followed immediately by the opening of contactor A, leaving the main winding in circuit directly across the lines for normal operation.

The torque/speed curves of the motor started by this method indicate an absence of violent torque fluctuation, and—more important still—the presence of a maintaining torque during the change from "start" to "run." For such applications as hoists and hydro-extractors, &c., this method should prove of considerable advantage.

An important feature of the method is the flexibility of pre-arranging the starting property of the motor, by giving the auxiliary winding the number of turns (such as 40, 50, and 60 per cent. of the turns embodied in the main winding) to suit any particular starting requirement.

Condenser System

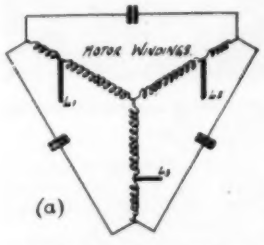
An extension of the method is the addition of a condenser, which, for a three-phase motor, would consist of three units connected in delta formation directly across the combined



Power factor of 8-h.p., 50-cycle, 3-phase motor: (A) Efficiency with condenser; (B) Efficiency without condenser; (C) Power factor with condenser; (D) Power factor without condenser

motor windings, the auxiliary winding being so proportioned as to provide the most economical voltage for the condenser. This system forms a compact self-contained squirrel-cage power-factor correction unit. With this combination, the main winding can be designed without regard to inherent power factor and the resultant current carried will be lower by the amount the power factor is improved; in certain cases, such as with slow-speed motors, an increase in output from a given frame size is possible.

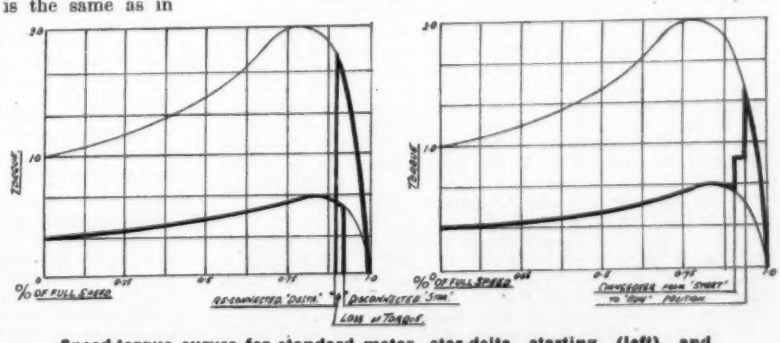
The efficiency and power factor curves reproduced compare the performances of the motors with and without the condenser. The condenser is operating right in the heart of the motor winding, which is the source of the low power factor, whereas a condenser connected directly across the mains is in parallel with the machine, and corrects the feeder power factor only.



Special motor, connected with condenser, for direct starting

The size of the main winding can therefore be reduced, with the result that there is very little difficulty in accommodating the auxiliary winding in the standard slot.

The system, for which British and foreign provisional patent rights have been obtained, can also be adapted for use with slow-speed slip-ring motors, resulting in a marked increase in efficiency with a consequent lower temperature rise.



Speed-torque curves for standard motor, star-delta starting (left) and special motor, contactor starting (right)

Inspection of Plant

An insurance company's technical report: Some useful welding data

THE publication of the Technical Report for 1930-31 of the British Engine, Boiler and Electrical Insurance Co., Ltd. (pp. 166, figs. 204, price 7s. 6d.) has been delayed owing to the time required to complete welding investigations.

Failures of parts of steam engines, cranes, and boilers are first dealt with by the report. Investigation of malpractice in forged boiler drum manufacture leads to the conclusion that it is more important for purchasers to specify a minimum Izod impact test acceptance value than the heat treatment which a manufacturer should or should not carry out. The structure, impurities, and processes of manufacturing plates and tubes are discussed.

In commenting on methods of correcting local errors introduced during manufacture, ill-carried-out repairs by welding are deplored. Such work demands considerable experience; serious heat stresses may be set up and the weld metal, unless of the best quality, is not suitable for withstanding alternating stresses; also a crack which starts in the weld may readily extend into the parent metal.

The report suggests that when it is, for instance, required to build up a shaft to allow it to fit a boss or receive a key it is preferable for some such metal as nickel to be deposited galvanically.

New Weld Tester

Most non-destructive methods of testing welded joints need special skill. The company has tried the "straight-away" method, which is of German origin and has the advantage of simplicity. The apparatus consists of an electrically driven vertical milling machine, which is tack welded on to the top of the joint; it merely mills a hole in any position of the joint, and a forward travel makes the hole oval and allows an increased area of weld metal to be examined. It is a simple matter afterwards to fill in the hole with fresh weld metal.

The report states that this method of testing welds appears to have excellent possibilities for practical application. At

Hotpoint-B.T.-H. washing machines being assembled at the Rugby works (see p. 733)

the same time, although serious defects wherever exposed at the surface of a hole were detected with ease, the surface of the holes in angle welds and reinforced butt welds was too rough to allow detection of minute defects.

The conclusions reached relative to overhead and vertical *versus* horizontal welding when using a metallic arc are that with an overhead weld there is the most difficulty in obtaining penetration to the back of the plate. With a heavily coated electrode, provided that a suitable covering is used, it is possible to lay a good quality weld metal when the plate lies overhead, or is vertical with the weld horizontal; judged, however, by the results obtained, uniform success is not to be relied upon.

With a lightly coated electrode the danger of entrapped slag is decreased, and, when the plate and weld are both vertical, better penetration to the back of the plate and more uniform weld metal is to be expected. Naturally, however, the metal, during its passage through the arc, is likely to be more contaminated by the atmosphere than when a more heavily coated electrode is used.

With a bare-wire weld troubles due to slag are avoided, but greater skill is required on the part of the operator. Though it is not to be expected that the ductility, the shock value, and the penetration will be so good when an ordinary bare-wire rod has been used, the tests have shown that, though oxide inclusions may be present, sound metal can be laid for each type of weld.

In general for vertical and overhead welds, especially the latter, oxy-acetylene is more difficult to apply than metallic-arc welding, but the metal can be laid satisfactorily by an experienced operator.

The Atomic Hydrogen Process

This method of welding has proved exceedingly useful for certain articles and is one which the company says that it would welcome for the welding of pressure vessels, especially when adapted for automatic welding. The special virtues it possesses are freedom from atmospheric contamination, both of oxygen and nitrogen. One apparent difficulty of manufacturers is the obtaining of good tensile properties, owing to decarburisation brought about by the hydrogen.

As a result of exhaustive tests the company has for some years looked upon the use of ordinary bare wire electrodes for pressure vessels with disfavour. Since the last report it has had no reason for modifying previous opinions. It is true that with covered electrodes there is danger of slag inclusion; the operator may neglect to remove the slag before laying a subsequent run, adopt too low a current value and cause insufficient fluidity of the slag, or use an electrode having a slag covering with too high a melting point. Though the use of bare wire eliminates these factors, it by no means necessarily removes danger of equally poor metal: inclusions may be present which are not accessible for the operator to remove.

The influence of the more common elements in inhibiting needles in nitrogen-rich steels and arc welds has been investigated, mainly to ascertain the alteration in the structure of hypo-eutectoid steel containing nitrogen when the more common constituents are added in quantity. The information was particularly required for arc welds in order that it might be possible from microscopic examination alone to determine within limits the extent to which a weld had been contaminated by the atmosphere; the more so as it is by no means uncommon to find that welds are highly contaminated, though under the microscope they appear to be made of high-class metal.

Ample proof is available that the structures found in welds contaminated by the atmosphere are exactly the same as those produced in nitrogenised steel. Again, the only difference between weld metal and steel of the same composition lies in the fact that a weld, especially when made with bare wire, contains a comparatively high oxygen content; this, however, never noticeably affected the structures found during the present experiments.

Inspection of Work

A remarkable expansion in this branch of the company's activities occurred during the year 1930, the percentage increase in the numbers of boilers and vessels insured and inspected establishing a record. This result was influenced, largely, by the influx of proposals for steam road vehicle boilers indirectly affected by the Road Traffic Act, 1930.

The returns for 1931 have not yet been completed, but from those available it would appear that the company is at last feeling the effect of the long continued industrial depression, as for the first time for several years the figures indicate that there has been a slight decrease instead of the usual increase in this class of business.

In the last technical report mention was made of a proposed modification with regard to the compulsory removal, at periodical intervals, of the brickwork in contact with boilers. It has since been explained that all the brickwork need not be removed simultaneously within the specified periods, but that a part may be removed each year until all the seams, drums, and headers are exposed at least once in the specified periods.

The supervision of the construction of new plant is one of the services undertaken by the company, and it also carries out inspections before actual manufacture is commenced so that it can be ascertained whether the design of the plant is satisfactory for the pressure and purpose required. For instance, a great deal of time and expense would have been saved if the procedure suggested had been adopted in the case of plant for impregnating with varnish or other compound, by means of the vacuum and pressure process, the windings of electrical units.

The installation consisted of a gas-fired water tube boiler suitable for a working pressure of 200lb. per sq. in.; a motor driven air compressor; a varnish tank; and a rectangular impregnating tank. The last named, which was of unusual construction, was fitted with an internal steam heating coil made of piping, 1¼ in. in bore, and was intended to withstand a working pressure of 100 lb. per sq. in. On inspection it transpired, however, that the impregnating tank had already been made, but had leaked under hydrostatic test. Its design was unsuitable and a new tank had to be made.

Returns of Mishaps

The report concludes with a synopsis of the reports issued by the Board of Trade under the Boiler Explosions Acts upon the explosions, collapses and sundry mishaps which occurred on land and at sea in 1929-30.

At a battery works one of the tubes in the bottom row of a 27-year-old water-tube 180-lb. B. & W. boiler ruptured due to overheating caused by internal deposit. At a power station a four-year-old 250-lb. wrought steel steam pipe opened out due to an imperfect lap weld. In another power station one of the tubes in the third row from the bottom of a 13-year-old 205-lb. B. & W. water-tube boiler ruptured, an imperfect weld being the cause. No casualties resulted.

Electric Road Vehicles

The Tramways, Light Railways, and Transport Congress

THE annual congress of the Tramways, Light Railways and Transport Association opened on Wednesday when a paper by Mr. L. B. Hewett was read on "The Layout of a Modern Tramway Depôt." The organisation of maintenance work has been an important factor in enabling the tramcar to hold its own in competition with other road vehicles. At the Finchley depôt of the Metropolitan Electric Tramways and L.U.T. Companies, in spite of the introduction of glazed car tops the average man-hours per car per week for cleaning have been reduced from 18 to 15¼ since 1914.

Mr. G. F. Sinclair, in "Experiences with Modern Tramcars," explains the present outward appearance of the tramcar by traffic requirements; depôt construction; track layout; and regulations imposed by the Metropolitan Public Carriage Act and the Ministry of Transport. Seats are provided for use during two two-hour peaks each day only, and the police regulations restricting the number of standing passengers to one-third of the lower deck seats rule out the most economical solution. The permissible increase of the number of standing passengers would allow 81 cars to be withdrawn from a fleet of over 1,500, and would enable a more comfortable car to be employed.

The car most suitable for London is the single-entrance type with a seating capacity of 66, and a standing area of 56 sq. ft. The car body should be treated as a box girder, and steel—not aluminium—should be used in lower saloon construction with a cast aluminium alloy top. Too little attention has been paid to the spring-borne motor, and too much to reducing the weight of the axle-hung motor, resulting in an uneconomical machine with a flat speed curve.

The Super-saturated Motor

An alternative solution is found in a series motor with a heavily saturated field, having part of the series field permanently in circuit, the induction of which prevents disturbance of the relationship between field and armature turns. As the tramcar is constantly accelerating and braking, it is the energy absorbed in the resistances which makes for high consumption. The standard motor comes off the rheostats at 12 to 15 m.p.h., and the super-saturated motor at between 6 and 7 m.p.h.; a reduction of energy consumption of 15 per cent. is anticipated.

A four-motor equipment costs more than a two-motor; it also takes more energy in the ratio of 2.6 to 2.4 kWh per car-mile, but the increase in acceleration is in very much greater proportion. Two-motor equipments driving on four axles are, however, being developed.

With car speeds of 30 m.p.h., magnetic braking on the last notches of the controller to supplement the preliminary rheostatic braking has been found efficient, but further research is needed for extending the practical scope of rheostatic braking, which is the least destructive to the track—the most costly part of a tramway system.

Mr. W. H. Shaw, in a survey of the new "U.C.C." Metropolitan Electric tramcars from the non-technical point of view, also advocates comfortable seats for base-load traffic and ample standing room for the rush hours. On the two routes over which only the new cars operate the traffic has increased by 2 and 6 per cent. in spite of trade depression.

Trends of Progress

Mr. G. H. Fletcher, dealing with "Modern Tramcar and Trolley-bus Equipments," states that the chief advance in tramcar construction during the last three years is in reduction of weight and increase in robustness of the motors and controllers. The weight of 600-V machines is about 27 lb. per h.p., or 23 lb. without gears and gear cases, although no aluminium is used, and steel castings, except the yoke, have been replaced by forged or pressed steel; the cast-brass brush box is the only other casting. Class B (mica and asbestos) insulation is coming into general use for both armatures and field coils.

Larger drum controllers and cam-contactor controllers have been developed to meet the needs of quick and frequent manual operation. An external magnetically operated line switch has been successfully introduced; it is so interlocked as to relieve the controller contacts of much of the arcing on opening circuit. Field diverters to give increased speeds on running notches have also been successfully applied.

Remote Control

Mr. Fletcher suggests that remote-controlled equipment should be considered, with a view to reducing the manual work required of the driver. This method is in use abroad (where the power braking is generally not electrical, but pneumatic), and is only an extension of the standard practice with trolley-buses for which the braking problem is easier.

In a recent development aiming at a reduction of track impacts and gear stresses, the motor is suspended on roller-type axle bearings through rubber springs and guides. The gear wheel is made resilient in the peripheral direction by oil-proof rubber inserts cast into place in the wheel. Modern operating conditions may result in combinations of circumstances, such as emergency braking coinciding with track irregularities, which may cause stresses in the gear teeth of values upwards of twelve times the stress at the one-hour rating.

The straight series motor does not meet the speed conditions of to-day; ten years ago the usual one-hour rating gave a speed of about 10 m.p.h., but to-day this is 15 to 18 m.p.h.

Regenerative control has been tried in Manchester and Glasgow. In Manchester the energy saving exceeded anticipation, and there have been no operating troubles. The experience obtained in Glasgow, after some preliminary troubles due to local conditions, showed that the system had decided advantages in suitable services; at a schedule speed of 10.2 m.p.h. under service conditions the energy saving was over 31 per cent. by regeneration, and an additional 3.7 per cent. apart from regeneration.

The Trolley-bus

The design of electrical components for the trolley-bus is more difficult than for the tramcar. The adhesion of rubber on road is much higher than steel tyre on rail, and the trolley-bus motor during rheostatic braking may be subjected to momentary overloads of about 1,000 per cent. above the one-hour rating. Commutation factors satisfactory for tramcars are therefore inadequate. The weight restrictions make it essential to employ high-speed motors with a maximum of ventilation, *e.g.*, 80 h.p. at 1,250 r.p.m. for a six-wheel bus on heavy schedules with rheostatic braking, having a weight of 12 lb. per h.p.

The tractive resistance per ton is about 40 per cent. higher than that for tramcars, which results in increased energy consumption. Compared with a single series motor with one stage of field weakening, two compound motors arranged for series-parallel regenerative operation showed an annual saving in cost of energy of 68 per cent., but the benefit was wiped out by extra weight and other factors. The best overall results were obtained by the use of a single compound motor with regeneration; the annual saving in energy cost was 44 per cent., which gave a saving of extra outlay of 59.5 per cent.

The "Talkatone" equipment described on page 732

Developments in Controllers

While the use of two motors on a tramcar is necessary for adhesion, their only advantage on a trolley-bus is the lower energy consumption consequent upon series-parallel connection. Early difficulties of regenerative control (mainly due to instability) have been overcome, and the system is now successful.

As the driver needs both hands free for steering and operating the hand-brake, pedal control is essential, but operation of the drum controller involved considerable effort and the difficulty of feeling the notches resulted in burning of the contacts. Contactors proved much more suitable, since they are either fully open or fully closed, while only the current required for their operating coils need be carried by the pedal-operated master controller. Non-automatic control is commonest in Britain; it allows the rate of acceleration to be entirely under the control of the driver but does not protect the motor so well. The present tendency is probably towards semi-automatic control.

Costs of the Heavy-oil Engine

Many claims have been made for the heavy-oil engine as a rival to the electrically propelled vehicle. In their paper "Oil Engines in Passenger Transport," Dr. H. F. Haworth and Mr. P. E. Biggar point out that although the present cost of heavy oil is temporarily uneconomic, the overall charges at present fuel prices show a saving of 1.35d. per bus mile with heavy oil. The first heavy-oil engine for passenger transport was put into service by Sheffield Corporation in 1930. During the past two years progress has been rapid and British manufacturers have produced oil engines that are technically among the most advanced in the world.

The Royal Society's Soirée

Some interesting scientific exhibits and demonstrations

THE annual conversazione of the Royal Society (president: Sir Frederick Gowland Hopkins) took place at Burlington House, Piccadilly, W., on May 11th, the customary display of scientific apparatus and demonstrations having been arranged by forty-five exhibitors—ten more than last year. Some of these exhibits are dealt with in the following notes.

In modern telegraph systems operated mechanically at high speed it is necessary that the signals should succeed each other at regular intervals, *i.e.*, there should be no "time distortion." The measurement of this factor has been made convenient by a three-piece testing set devised by Standard Telephones & Cables, Ltd., which enables a check to be kept upon the transmission condition of lines and terminal apparatus.

A special receiver replaces the recording mechanism at the receiving end of the line. It is a timing device which shows how early or late each individual signal arrives, by means of a cathode-ray oscillograph. The flashes are constrained to move in a circular path by means of a rotating electric field applied to the four deflecting plates from an auxiliary oscillator. The latter, and hence the rotating deflecting field, is adjusted manually to synchronise with the average speed in bauds of the transmission to be tested. Succeeding flashes on the oscillograph screen therefore appear to be spread out over a segment of the polar scale, the time between the earliest and latest signals in terms of one time unit, or the average speed in bauds, being easily read off. The percentage distortion may therefore be quantitively measured.

The production of the flashes is accomplished by making the marking and spacing contacts of the receiving relay alternately charge two condensers from a battery through the primary of a step-up transformer, the secondary terminals of which are respectively connected to the anode and cathode of the oscillograph tube.

A Reference Standard

As measurements of this kind are primarily conducted to locate faulty components or adjustments by a process of elimination, it is essential to have a reference standard which produces perfect signals. A test transmitter fulfils this function. A motor-driven sequence switch produces various types of signals which an auxiliary telegraph relay "cleans up," so that almost perfect signals free from time distortion are available for transmission through the system under test.

To achieve the required degree of synchronism between the transmission and the rotating deflecting field in the receiver, necessary for testing on long-distance lines, the sequence switch is driven by a synchronous motor whose speed is directly controlled by an auxiliary oscillator through a relay. It covers a range from approximately 30 up to 250 p.p.s., and has two independent outputs, which can simultaneously drive the relays in the test transmitter and also provide the polar time scale in the test receiver.

A Smoke Recorder

Light diffracted by the suspended matter is used as the basis of measurement in the smoke or dust recorder of the Cambridge Instrument Co., Ltd. The optical system is arranged along one axis, but in reality consists of two parts. The first produces a beam converging to a definite real image of the illuminating lamp filament, and a column of smoke is caused to cross this beam. Light diffracted by the smoke particles falls on a large condenser lens, which forms the second part of the optical system in conjunction with suitable stops, so accurately placed as to intercept the direct or illuminating beam, while offering little obstruction to the scattered beam, which ultimately falls on a photo-electric cell. The photo-electric current, being a measure of the quantity of smoke, is recorded without amplification on a thread recorder working ballistically. The instrument was shown operating from a.c. mains.

The research laboratories of the General Electric Co., Ltd., demonstrated the progress which is being made with apparatus for the generation and detection of ultra-short continuous waves (wavelengths of less than one metre) and some of the simpler phenomena of their propagation. The recently developed short-wave magnetron oscillator and apparatus of the Barkhausen-Kurz type were also on view.

Wave Character of Electrons

Prof. G. P. Thomson had arranged an experiment to illustrate the wave character of electrons (cathode rays) by showing the diffraction patterns formed when they are reflected from a single crystal of copper. The atoms in a plane of the crystal act like a two-dimensional diffraction grating, such as would be formed by two optical gratings crossed. When the diffracted electron beams hit the screen they make it fluoresce, and spots are seen corresponding to spectra of different orders. The apparatus in its present form was designed and made by Mr. C. G. Fraser, of Aberdeen University.

Sir Gerald Lenox-Conyngham demonstrated the simultaneous registration of pendulum oscillations and wireless time signals. Two pendulums are swung in an evacuated box in opposite phase. Light reflected from mirrors on the pendulums passes over a slit as the pendulums pass through their equilibrium positions, and falls on a piece of bromide paper on a rotating drum. Wireless time signals are also recorded on the same drum by a beam of light reflected from the mirror of an oscillograph.

Imperial Chemical Industries (Alkali), Ltd., showed some apparatus developed in its research laboratories, including quartz springs and electrical insulation ("Pyrex" glass in steel "windows") for high-pressure work, which has withstood long service at 3,000 atms. and temperatures up to 180 deg. C.

The research department at Woolwich Arsenal had a selection of comparative radiographs of engineering structures obtained by γ and X-rays. Also a 400-kVA, 20-mA, X-ray tube designed to operate continuously on pumps and protected by encircling the glass cylinder with a thick metallic lead cylinder.

Dr. G. D. West's demonstration consisted in allowing a drop of electrolyte to fall into the space between two electrodes immersed in distilled water. When a field of about 50 volts per cm. is applied, the drop spreads out into a long filament parallel to the lines of force. The phenomenon can be explained by the pulls of the tubes of force that emanate from the electrodes, and finish on the charges at the ends of the drop.

Radio-frequency Measurement

At the National Physical Laboratory a quartz ring oscillator and chromograph are used for radio-frequency and other measurements (the late Dr. W. D. Dye). The change of dimensions of a quartz crystal, when electrically polarised, has been adopted to produce periodic circumferential expansion and contraction of a ring, with the object of obtaining great constancy of time of oscillation. Steadiness of the order of 1 or 2 parts in 100 millions may be attainable. The frequency of the ring shown, which depends upon its dimensions and mechanical properties, is 20,000 per second.

The chronograph enables the rate of the driving source, of 1,000 cycles per second, in this case the twentieth subharmonic of the above quartz ring oscillator, to be accurately compared with that of a standard clock.

In the Laboratory's electrical capacity recording dilatometer (Mr. W. E. Prytherch) oscillations of magnitude critically dependent on the capacity of a small 2-plate condenser are generated by a simple valve circuit. One plate of the condenser is connected to the specimen whose expansion is being recorded, the specimen being mounted inside an electric furnace. Changes in the oscillations induced by the variation in the condenser cause changes in the plate current of the valve, which are recorded simultaneously with the temperature of the specimen on a thread recorder.

Diverse applications at the N.P.L. of X-ray analysis to industrial and manufacturing processes and to the examination of materials were illustrated by a series of photographs (Dr. G. Shearer and Messrs. W. A. Wood and J. Thewlis).

Radio Research Demonstrations

The Department of Scientific and Industrial Research (Mr. R. A. Watson Watt) illustrated some of the uses of cathode-ray oscillographs in radio research, including the principles of the photography of atmospheric wave-forms, direction finding with the oscillograph, study of ionisation in the upper atmosphere using wireless echoes of short delay, analysis of the state of polarisation of received short waves, and the location of thunderstorms by photographic direction-finding. The demonstrations were made in collaboration with Prof. E. V. Appleton and Mr. G. Builder, of King's College; the pulse signals came from the East London College.

The Government Laboratory demonstrated the photo-conductivity of diamonds of the transparent type when exposed to ultra-violet light.

Messrs. Adam Hilger, Ltd., showed new apparatus for rapid ultra-violet spectrophotometry, an X-ray metallograph, etc.

The high-speed thyratron counter devised by Dr. C. E. Wynn-Williams enables rapidly recurring physical events to be counted automatically, even when the time interval between two events is only 1/1250th second. In conjunction with a valve amplifier, the apparatus is used at the Cavendish Laboratory for the automatic counting of α-particles.

Mr. C. Morton showed recording and indicating thermionic electrometers and hydrogen-ion meters; a triode valve is used with a pointer galvanometer as the null-point indicator. Prof. A. V. Hill demonstrated the heat production of muscle and nerve twitch, including galvanometer amplification by photo-electric cell.

Approved Shotfiring Apparatus

The Secretary for Mines announces that the "Safetex" low-voltage magneto electric exploder for single shots, manufactured by Messrs. Schaffler and Co., of Vienna, and submitted for test by Messrs. Hunter & Warren, Ltd., Glasgow, has been approved for use in all coal mines to which Part II of the Explosives in Coal Mines Order of September 1st, 1913, applies.

Correspondence

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession

The Paris Fair

Referring to your article on the Paris Fair in to-day's REVIEW, it may be of interest to you to know that our British-made "Chromalox" high-speed boiling plates are fitted exclusively on the cookers and boiling plates of the Fondéries Arthur Martin of Revin, Ardennes and Paris, and also of the Société Alsacienne de Constructions Mécaniques & Compagnie Française Thomson-Houston, Alsthom, of Paris, probably the two largest manufacturers of electric cooking apparatus in France. Our "Chromalox" plates are also being exclusively used by the Officine di Sesto S. Giovanni & Valsecchi Abramo, of Milan, and the Fondéries Nestor Martin, Berchem Ste. Agathe, Brussels, again probably the two largest manufacturers in their respective countries.

Leeds, *May 13th*, 1932. GEO. BRAY & CO., LTD.

In connection with the article on the Paris Fair in your issue of to-day, in which regret is expressed that more British firms did not take advantage of the international character of the Fair and of the size of the French market to exhibit, we would like to state that 2,000 copies of the enclosed three-language booklet drawing attention to the industrial advantages of our supply area are now being distributed at the Fair by the Federation of British Industries.

LANCASHIRE ELECTRIC POWER CO.

Manchester, *May 13th*, 1932. (R. P. D. Downe.)

[The booklet referred to is a well-produced illustrated brochure in English, German, and French and it reflects great credit upon the company's enterprise.—EDS., ELEC. REV.]

Tariffs and the Irish Free State

If it were not that I have recently had first-hand evidence that the reminder is necessary, I should not presume to ask those manufacturers, factors, and agents who handle electrical machinery and apparatus which is made partly or wholly abroad to remember that the I.F.S. is, and always has been, fiscally separated from Great Britain and Northern Ireland. Therefore the protective duties imposed by the British Parliament upon imported goods have no application to goods imported into the I.F.S. from abroad, unless, of course, such goods have had to be cleared through a British port.

The greater part of the electrical goods imported by customers in the I.F.S. is manufactured wholly in Great Britain; part derives direct from the Continent or from North America; and the remainder either is manufactured in part in British factories or is a foreign product re-exported to the I.F.S.

This little State is very much in the news just now, as some of you may have noticed, and as that kind of thing always induces misapprehensions it is quite likely an idea may get about that the I.F.S. Parliament has imposed, or is about to impose, duties upon this, that, and the other electrical goods.

Ever since the British imposed the "McKenna" duties, which applied at that time to Ireland as well as to Great Britain, the I.F.S. purchasers of wireless sets and components have been mulcted very heavily in what is—for the I.F.S.—entirely and admittedly a tax for revenue purposes; but at no time has there been danger of a tax for any purpose being levied upon other electrical commodities. It is unlikely in the highest degree that a State which owns and operates the National Electricity Supply Undertaking would check the development of that undertaking by the imposition of revenue tariffs upon electrical apparatus.

Another fact which is not known in Great Britain as widely as might be supposed is that there is a Trade Commissioner, appointed by the British Government, with permanent offices in Dublin, whose duty it is to foster British trade with the I.F.S. That he does so with great energy and effectiveness is common knowledge over here, and should be so on your side.

Dublin, May 10th, 1932. OBSERVER.

Yokes for Electric Motors

A well-known firm of machine-tool makers has quite recently put on the market a draw-cut shaping machine—designed especially for machining the flats on the inside of the yokes of motors and generators—on which the field poles are fixed.

Without for a moment suggesting any disparagement of an obviously splendid machine, the practical question arises in my mind: "Why have flat surfaces at all?" Why not have curved seats, *i.e.*, seats bored, with circumferential registers, too, at the same setting on the lathe as when the faces and the cover seats of the yokes are machined? Cost for cost, as well as for an easy path to accuracy, the curved (bored) way is far superior.

The method also applies to the pole-pieces themselves; these may be turned in batches on a suitable mandrel fixed to the face plate. For this purpose the mandrel is turned a sufficient amount smaller than the required finished bore of the pole-pieces, and the pole-pieces, with their roughly cast curved parts, are clipped to the mandrel.

Should the design comprise pole-shoes of the laminated kind, the diameter of the mandrel is turned only slightly less than the required finished bore, so that just a skim may be taken through them subsequent to their attachment to the pole-pieces.

In suggesting curved surfaces, I am by no means on strange ground having for many years been in charge of shops producing motors and generators, where flat faces were abandoned in favour of curved ones years ago—with considerable gain all round. A LONDON FOREMAN.

May 12th, 1932.

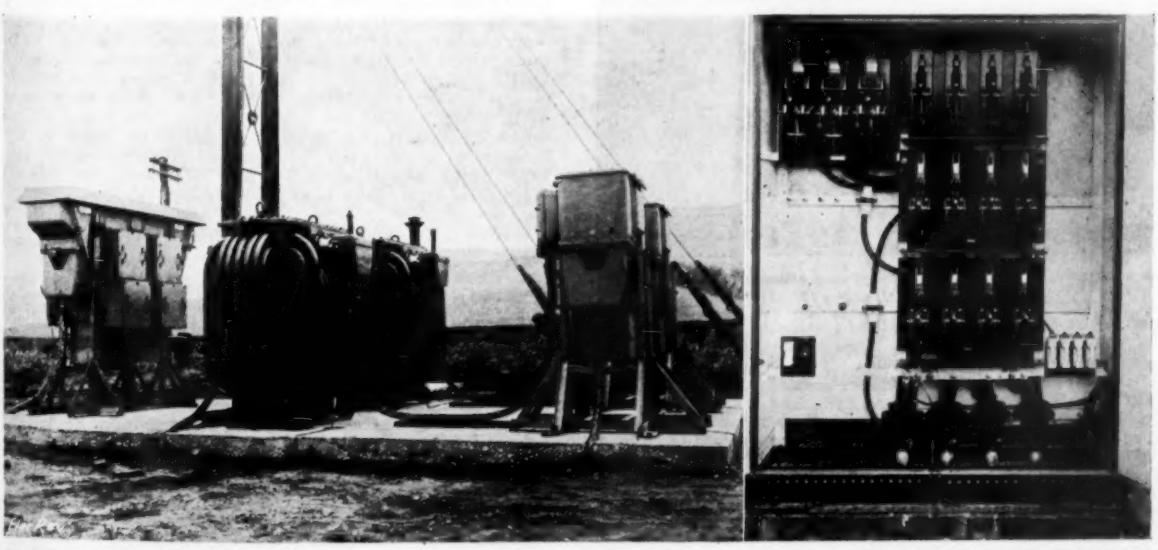
Earthing

A letter in your issue this week tempts me into print on a subject that is of growing importance, *i.e.*, the effective earthing of domestic apparatus.

I believe that most engineers consider the third wire and earth pin a nuisance. I have never yet seen an electric flat iron with the extra earth wire, but no doubt it has been produced.

My proposal is that all installations should be transformer fed and one side of the transformer output earthed. Also all domestic apparatus should have the metalwork connected to the earthed side of the output winding of the installation transformer.

This would make the apparatus safe and require only twin flex and no special earthing fittings. There would then be no question of the earth lead resistance. An insulation failure would blow the local fuse at once.



The Girvan Electricity Scheme (see p. 754): Main outdoor sub-station in course of erection: 11-kV four-panel switchboard on left, two 3.3-kV switch units on right. L.p. compartment of kiosks showing Statter air-break breakers instead of fuses on feeder and distributor cables.

The question of additional cost per installation arises, of course. But if all houses (or, better still, all consumers) were compelled to have transformer feeds the immediate demand would be for a million or so of the small house size, say, 2 kW. This would reduce the price and make for more work in these hard times.

F. L. BEST.

New Barnet, *May 13th*, 1932.

Motors or Condensers?

Your correspondent, Mr. Dorey, entirely misses the point of my letter to you on this subject, and misconstrues one sentence into an attack on the static condenser. Perhaps when he has had a little more experience in the respective merits of condensers and synchronous induction motors (which, by the way, he terms "some form of compensated motor") he will be better able to appreciate the matter in its entirety.

The writer has no interest in the manufacture or sale of either static condensers or synchronous motors.

May 13th, 1932. J. P. S. P.

I would like to endorse the remarks of your correspondent in the current issue of the ELECTRICAL REVIEW under the above heading. Mr. E. W. Dorey sums up the whole situation in his statement that "there is nothing so reliable and robust on the market to-day as a collection of induction motors of the squirrel-cage or slip-ring types combined with a well-designed static-condenser equipment."

Reliability is of paramount importance to-day, and the static condenser scheme is superior in this respect to any other; particularly is this the case if circumstances are such as to allow the use of squirrel-cage motors. In addition to which, the overall efficiency is better, the control gear is simplified, maintenance charges are lower and, finally, the total initial capital outlay is less than for equipments involving the use of synchronous type machines with intricate switchgear and necessary skilled attention.

Mr. Dorey hits the nail on the head in his concluding paragraph. A great deal of the trouble to which he refers is due to the over-enthusiastic salesman who ignores, deliberately or otherwise, the necessary financial and technical considerations involved in any particular application, the result being another dissatisfied consumer of electrical energy.

Prestwich, Manchester, *May 14th*, 1932. D. DYSON RAYNER.

Who Should Receive Trade Discounts?

Referring to "Grad. I.E.E.'s" letter in your current issue, in which he mentions his spare-time electrical contracting activities, we can only leave it to his own conscience as to whether he is "playing cricket" when regard is paid to the distressing circumstances in which some of his unemployed colleagues are placed, due to the economic conditions now prevailing.

DUM VIVIMUS VIVIMUS.

May 16th, 1932.

A Desirable Load

The photograph of the high-voltage electrode steam-raiser or water-heater on the back cover of to-day's ELECTRICAL REVIEW should attract attention.

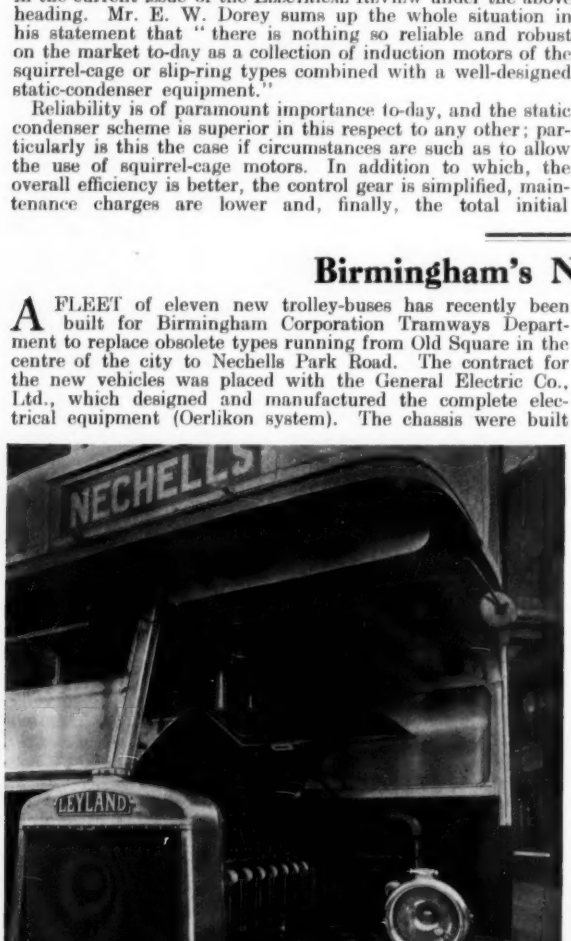
We are familiar with certain potential consumers who require steam in their works and who therefore install their own prime-movers. Surely it would be a good point to suggest that electric power is available for supplying steam as well as for driving the machinery.

Power for domestic central heating should be almost gratis with automatic off-peak control. Is it advertised enough?

May 13th, 1932. OBSERVER.

Birmingham's New Trolley-buses

A FLEET of eleven new trolley-buses has recently been built for Birmingham Corporation Tramways Department to replace obsolete types running from Old Square in the centre of the city to Nechells Park Road. The contract for the new vehicles was placed with the General Electric Co., Ltd., which designed and manufactured the complete electrical equipment (Oerlikon system). The chassis were built



A view of a Leyland-G.E.C. trolley-bus showing contactors and circuit breaker and change-over switch above

by Leyland Motors, Ltd., and embody the main characteristics of the "Titan" double-deck petrol chassis. The bodies were supplied by Messrs. Short Bros.

In general appearance these trolley-buses are little different from the conventional double-deck petrol bus, and have the usual half-cab, Leyland radiator shell and half-bonnet, with the driver in the forward position. Accommodation is provided for forty-eight passengers.

The relatively light weight of the chassis, in conjunction with the high power output of the 65-h.p., 500-V, G.E.C. traction motor, has resulted in the vehicle having rapid acceleration and high speed. The power unit is mounted well forward on the chassis, almost in the position normally occupied by the engine and gear box of a petrol vehicle. The motor construction is of the box type, its frame being a steel casting of high magnetic permeability. Special precautions have been taken in the design to eliminate hum from the motor throughout the entire range of speed.

The drive is taken to the rear axle by means of a two-piece propeller-shaft, at the forward end of which is a fabric-type coupling, the remaining couplings being of the "Spicer" all-metallic type. This transmission line is off-set to permit of a low central gangway in the bus and a consequent reduction of the overall height, the low centre of gravity thus obtained giving exceptional stability. Operating safety is further ensured by powerful vacuum-operated brakes. The rear axle is worm driven and is of the full-floating construction, with an axle ratio of 10.66 to 1.

Easily Accessible Control

Control of the speed of the motor is effected by a foot-operated master controller, the pedal of which is adjustable to suit the convenience of the driver. It is operated in a similar manner to the accelerator of a petrol-driven vehicle. Notches for field shunting and a hand-operated reversing switch are incorporated in the master controller, which is provided with a removable cover that renders the interior easily accessible.

The group of electro-magnetic contactors is assembled longitudinally on a panel mounted directly above the motor, thus keeping cable connections as short as possible. The space beneath the bonnet is particularly suitable for the location of equipment such as control gear and braking auxiliaries, and such small noises as may be created by the control gear in operation is inaudible to passengers in the vehicle.

"Unbreakable," non-rusting grid type resistances are mounted in suitable positions on each side of the chassis, while double-pole protection of the entire equipment is afforded by two automatic overload circuit breakers which, when necessary, can be reset by the driver without leaving his seat. Maximum lateral deviation of the vehicle has been made possible by the design adopted for the collector gear. This consists of two independent trolleys, allowing a range of deviation of 15 ft. either side of the overhead wires. Fully loaded, the buses are capable of a speed of 35 m.p.h. on the level, the acceleration to 14 m.p.h. with normal operation of the controller being approximately 2 m.p.h. per second. Correspondingly rapid retardation is provided by vacuum brakes operating on all four wheels. The vacuum is created by a "Reavell" exhauster driven by a separate electric motor.

Standard Specification for Cranes

A revision has been issued of British Standard Specification No. 327, Part 1, "Power-driven Derrick Cranes." A recent requirement of the Building (Amendment) Regulations is that all cranes used in building construction shall comply with the Specification. The modifications tend towards a slight easing in the stringency of the design requirements. The general factor of safety has been lowered to a minimum of 4¼, but no change has been made in the minimum factors of safety of gearing or wire ropes or the maximum working stresses for other components. The Specification now permits the use of fusion welded joints. The Statutory Regulations affecting cranes in Great Britain have been included as an appendix, as well as a list of all British Standard Specifications to which the crane maker has to work. Copies of this Specification may be obtained from the British Standards Institution, Publications Department, 28, Victoria Street, S.W.1, price 2s. 2d., post free.

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

A New Vacuum Cleaner

A vacuum cleaner introduced to meet the demand for a low-priced light-weight cleaner is the "Demon," supplied by L. BENN & Co., LTD., 8, Colonial Avenue, Minories, E.C.3. The "Demon" vacuum cleaner weighs 7 lb., and is fitted with a

The "Demon" vacuum cleaner

universal (a.c. or d.c.) motor, which is well insulated from the body of the machine. Oiling is unnecessary as ball bearings are used; the rating is 180 watts. Twenty feet of flex with plug and adaptor are provided, and the cleaner is guaranteed for twelve months.

Improved Switch Fuses

THE REVO ELECTRIC CO., LTD., Britannia Works, Tividale, Tipton, Staffs, announces an improvement in the 15A "Revette" switch fuse, which now incorporates a positive quick make and break action. The design of the 30A switch-fuse has also been modified; wiring is effected at the top and bottom, and the holes have wooden bushes which can be removed to take a standard conduit.

A new splitter switch-fuse of substantial construction made by the company incorporates in one unit a double-pole main switch and a 2-way double-pole fuseboard of 15 A capacity.

The Ozonator Air Purifier

A compact air-purifying machine has been produced by the UNITED UTILITY CO., LTD., Wendy House, 12 and 14, Denman Street, W.1. The "Ozonator," as it is called, converts a small quantity of the oxygen into its highly active form of ozone. The extreme activity of ozone oxidises impurities in the surrounding air reverting itself to pure oxygen. The method is based upon the effect of lightning during a thunderstorm. The machine, which is rated at 33 W, will purify 30,000 cu. ft. of air per hour, and works off a 200-230 V a.c. supply. Models for 110-130 V and 220-250 V can also be supplied to order. The electrical apparatus is housed in a polished grained oak cabinet with a metal dome.

The "Ozonator"

A Steam De-superheater

The V.N. model de-superheater introduced by the DRAYTON REGULATOR & INSTRUMENT CO., LTD., West Drayton, Middlesex, consists of a wrought steel vertical shell, the size of which is determined by the quantity of steam to be handled, and the quantity of superheat to be removed. The steam enters a relatively large diameter central tube at a greatly reduced velocity, meets the injection water, and passes over a series of baffle plates below the nozzle to ensure intimate contact between the steam and water.

The de-superheated steam then passes through a spiral separator between the central and the outer tube shell. Any trace of entrained water is thrown against the shell and finds its way to the bottom of the shell, whence it is removed by the steam trap.

The quantity of water is regulated to maintain a constant temperature of the outlet, regardless of load variations, by means of the company's regulator.

A New L.T. Coachscrew Spindle

THE BETTER LINES CO., 24, Bird Street, Lichfield, has recently marketed a new coachscrew spindle for insulator supports. This has a hexagonal collar on a ⅝-in. diameter plain pin, a shackle insulator 2½ in. by 3 in. being carried above the collar and secured in position by a washer and split pin. Below the collar is a cast-iron spacing tube cut to an angle of 45 deg. at one end, which provides a seating as the pointed end of the spindle is screwed into the pole.

The spacing tube bears against a strip of metal or a two stranded wire forming an effective bonding between the fittings. The spindle permits a triangular formation of conductors, the neutral being staggered in the pins, and the use of a 26-ft. pole in place of the usual 28-ft. pole, while the conductors lie directly on the insulator and have no shrouding metal.

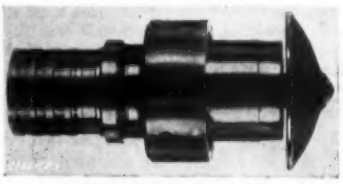
The method of fitting is by first drilling a ⅝-in. diameter hole at an angle of 45 deg., when the spindle is threaded through the spacing tube and screwed into the hole through the bonding strip forming a watertight joint. The spindle has been tested to withstand 7 cwt.

A Silent Tumbler Switch

THE GENERAL ELECTRIC CO., Magnet House, Kingsway, W.C.2, is now manufacturing a new quick make and break switch which is silent in action. The "Silent Landor" embodies the underslung movement of the standard "Landor" switches, and silencing is effected by the use of buffers against which the underslung moving member comes to rest. These buffers are fixed to the porcelain base and are made from a non-perishable india-rubber compound. This 5A switch is made in surface, semi-recessed and flush types, with either one- or two-way movements.

A Self-propelling Nozzle

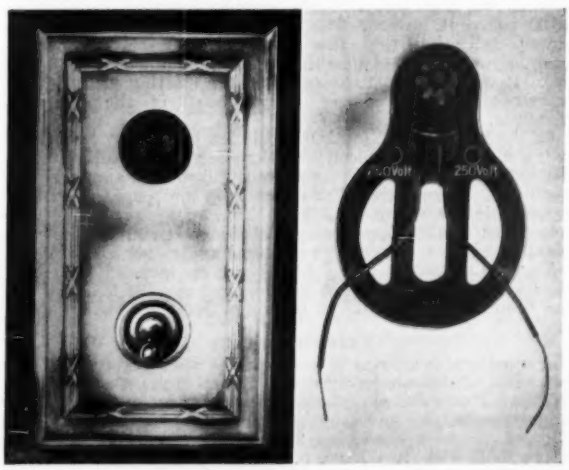
The electrical interest of the "Super Three" self-propelling nozzle developed by MR. JOHN NORWORTH, Bush House, London, W.C.2, lies in its ability to clear power-station drains choked by pulverised fuel and other dust. The nozzle has three jets and is propelled by water from a hydrant or other pressure supply. The design is such as to give the water a hammer action and the nozzle revolves pulling the hose up the drain under its own power. A steel dome deflects the water on to the sides of the pipe at high velocity, and as the nozzle works against the natural flow of the water, the silt and solid matter comes back to the opening with the water released. The nozzle has four bearings (two weight and two thrust) with non-rustable balls, which are lubricated through one hole with a countersunk screw. Two models are available: No. 7 for pipes from 6 to 24 in. in diameter and No. 5 for 4½- to 12-in. pipes.



The "Super Three" nozzle

A Switch Indicator Lamp

A small lamp has recently been marketed which is used to indicate the position of any switch in darkness. The lamp is applicable to standard wall switches of all types. In the case of the flat switch the "Bakelite" plate connected to the lamp is placed between the wall and the base of the switch, while the two leads are connected to the switch terminals. A very high resistance is in series with the lamp, so that when the main lamps are off it is always glowing, but when the main lamps are alight the resistance in the pilot lamp circuit prevents it from functioning. The lamps are supplied to give a light of any colour, thus serving as indicators for a group of switches. As a precaution against theft, the lamp may be set with the holding screw in the side of the lamp facing the switch, so that the lamp cannot be taken out without first



A switch indicator

removing the switch. The glow lamp is also supplied for use with flush switches, and takes only 0.1 W at 200-250 V. Other standard voltages are also catered for. The indicator, which is entirely British, is made by S. OFFENBACHER & Co., 81, Milton Street, Sydney Avenue, E.C.2.

Trade in Canada

A D.O.T. survey of economic conditions

IN view of the forthcoming Imperial Conference to be held at Ottawa next July, a Department of Overseas Trade report on economic conditions in Canada (Stationery Office, 4s. 6d.), prepared by Mr. F. W. Field, H.M. Senior Trade Commissioner in Canada and Newfoundland, is of particular interest, more especially as the author has given special attention to features likely to prove of value when considering the problems to be discussed there.

Dealing with general conditions, Mr. Field observes that the current situation in Canada reflects the difficulties experienced as a result of two years of world-wide depression. The Dominion is largely dependent upon markets for the disposition of its products, and, as a result, has keenly felt the decreased purchasing power of its customers. In addition to the declining trend of general business, Canadian industry has had to contend with the confusion resulting from numerous adjustments of its foreign exchange relationships.

The low price of the pound sterling in Canada led to a number of additional inquiries in that country for prices of United Kingdom products. The extent to which Canadian funds are below gold parity checked imports from the United States and other gold standard countries and tended to assist Canadian manufacturers.

The avowed policy of the present Government is to afford Canadian manufacturers a full measure of protection. The upward revision of the tariff has naturally restricted the Canadian business of the United Kingdom and in certain instances trade is now difficult or impossible.

The Trade Commissioner adds that Canada is probably in a better general condition at this time than is any other country. Canada still has vast natural wealth and strong recuperative power, but, if the depression continues much longer, then the country may encounter more difficulties than in the past. As soon as world conditions improve, the Dominion is likely to be one of the first countries to recover.

Hydro-electric Development

The utilisation of the abundant water power has enabled the country to advance rapidly from an almost wholly agricultural country to a manufacturing country of importance.

The development of water power has had a direct and extensive effect in reducing the consumption of coal; Canadian Government experts estimate that each installed h.p. saves 5¼ tons of coal per annum.

At the end of 1930, Canada's hydro-electric installation amounted to 6,125,012 h.p. Between 500,000 and 600,000 h.p. was added to the total during 1931, and an additional 2,500,000 h.p. is in active prospect. About $80 millions was expended upon water-power development in 1930, and approximately $300 millions is being spent during the period 1931-33. These activities have extended throughout every province except Prince Edward Island, and a noteworthy feature of the construction is that, with one minor exception, the entire installation is developed for public distribution through central electric station organisations.

Available Resources

According to an interesting survey of the Dominion Water Power and Hydrometric Bureau, the known available water power in Canada from all sources is 20,347,400 h.p. for conditions of ordinary minimum flow, and 33,617,200 h.p. for ordinarily available for six months of the year. An analysis of plants concerning which complete data are available as to turbine installation and satisfactory information as to stream flow shows, however, that the average machine installation is 30 per cent. greater than the ordinary six months' flow power, indicating that the water-power resources so far recorded will permit of a turbine installation of about 43,700,000 h.p. It will be seen, therefore, that the existing installations represent only slightly over 14 per cent. of the recorded resources.

Of the total of 6,125,012 h.p., 5,214,336 h.p., or 85 per cent., is installed in central electric stations for general distribution for industrial, municipal, commercial, domestic and agricultural use. General installations at pulp and paper mills are responsible for a further 579,826 h.p., or 9½ per cent., the remainder (330,850 h.p.) being installed in general industrial plants, such as mines, electro-chemical works, &c.

There is at present nearly $1,390 millions invested in hydro-electric installations, and of this amount over $1,168 millions has been expended on lands, buildings, plant, and equipment.

Recent Projects

A considerable amount of development work was carried out last year. In Manitoba the Seven Sisters plant of the North-Western Power Co. was started up with three units operating under partial head and capable of producing 60,000 h.p. The City of Winnipeg also placed in operation its new plant at Slave Falls with two 12,000-h.p. units, while in Ontario the Chats Falls development on the Ottawa River, jointly undertaken by the Hydro-Electric Power Commission of Ontario and the Ottawa Valley Power Co., came into initial operation with four units. The Commission also installed transformers with a capacity of 90,000 kVA at the Toronto-Leaside station and a steel tower line from Leaside to Chats Falls, a distance of 200 miles, was constructed.

The Alexander development was completed by the Commission, and has now a capacity of 45,000 kVA. A steel tower transmission line was constructed from Hunta to Sudbury, a distance of 189 miles, and approximately 1,200 miles of rural primary lines were completed during the year. In Quebec, the Maclaren-Quebec Power Co. commenced and made good progress with a 125,000-h.p. plant on the Lievre River, below Buckingham.

The Shawinigan Water and Power Co. completed a storage dam costing $4 millions on the Mathawin River and installed additional units at Shawinigan Falls, Grand' Mere, and La Gabelle. A 200,000-h.p. project at Rapide Blanc on the Upper St. Maurice is rapidly nearing completion, and by the end of the current year the Shawinigan Co. will own or control developed power amounting to 1,032,000 h.p.

Electrical Production and Imports

The electrical apparatus and supplies industry in Canada is extensive, and the official returns of the industry for 1929, issued last year, indicate production valued at nearly $114 millions, which compares with $56 millions in 1920.

Below is given a comparison of the imports of the main groups of electrical apparatus from the principal supplying countries during 1930 and 1931 :—

	1930. Thou. $	1931. Thou. $	Inc. or dec. Thou. $
Dynamos and generators—			
Total	2,487	1,263	− 1,224
From United Kingdom	534	337	− 197
„ Sweden	113	243	+ 130
„ United States	1,805	682	− 1,122
Meters—			
Total	391	354	− 37
From United Kingdom	53	89	+ 36
„ United States	335	262	− 73
Motors—			
Total	4,657	2,716	− 1,941
From United Kingdom	627	567	− 60
„ Germany	26	*	*
„ Sweden	84	15	− 69
„ Switzerland	3	*	*
„ United States	3,889	2,102	− 1,787
Rheostats, controllers and other starting and controlling devices—			
Total	858	544	− 314
From United Kingdom	72	69	− 3
„ Sweden	14	*	*
„ United States	769	463	− 306
Switches, switchboards, n.o.p. circuit breakers, and parts—			
Total	2,783	1,438	− 1,345
From United Kingdom	328	155	− 173
„ Sweden	—	43	+ 43
„ Switzerland	5	13	+ 8
„ United States	2,448	1,224	− 1,224
Transformers—			
Total	817	780	− 37
From United Kingdom	111	386	+ 275
„ Sweden	—	*	*
„ Switzerland	56	—	− 56
„ United States	647	390	− 257

* Returns not available.

Electric motors are a branch of the industry in which British manufacturers are considerably interested, and during the past six years their business in Canada has increased by 64 per cent., as against a gain of only 14 per cent. by the United States.

The United States sells the majority of the electricity meters, rheostats, &c., imported into the country, though United Kingdom trade, in relatively small volume, shows a tendency to increase.

Outdoor type metal-clad switchgear is comparatively new in the Canadian market, although several installations have been made. United Kingdom manufacturers are in an excellent position to supply this type of equipment.

It is gratifying to note that last year for the first time the United Kingdom's share of the imports of transformers was practically equal to that of the United States.

The " Made in Canada " Campaign

British electrical manufacturers have had to face a strong " Made in Canada " movement, Government and municipal authorities almost invariably specifying that equipment required by them must be made in the Dominion.

The fairly good volume of sales of electrical equipment last year was largely the result of the continued demand throughout the country for additional supplies of power. This demand arises from the constantly widening use of electrical devices in industry, in trade, on the railways, and for domestic purposes. The outlook for future business is fair.

According to the latest Government returns, sales of radio receivers in the first six months of 1931 amounted to 75,745 sets valued at $6,385,555 (factory selling prices). These sales included 68,395 a.c. sets ($5,410,914), 5,414 a.c. radio-gramophones ($861,001), and 1,936 battery sets ($113,640).

While the production of radio receivers in Canada is an active industry, the imports are maintained at a high level, being valued at $8 millions for the year ended March, 1931. With the exception of imports valued at $66,000 from the United Kingdom and $41,000 from Switzerland, the apparatus came from the United States. There appears to be little prospect of increased trade for the United Kingdom in this branch of the electrical trade.

Problems of Management. By H. N. Munro, F.I.I.A.

Qualifications for executive control

EXAMINATION into the causes of many commercial failures in recent years points to the main defect as being concerned with weak management: not necessarily weak in the technical sense, but lacking the stability which is the essential of complete industrial control. All businesses if they are to be going concerns must be actuated by the application of administration, and the true function of management is concerned primarily with the skill and economy of administration which is at the same time a differentiation of functions and a co-ordination of them.

The creation of big units and the consolidation of small concerns has emphasised the importance of the question as to how far control can be exercised without robbing it of initiative or overloading it with responsibilities, how far such control permits not only immediate supervision of close-at-hand functions but what has come to be known as "management at a distance," and exactly how control can be measured.

We are learning as the result of trial and error experiments that management has a technique of its own, needs a training of its own, and requires its own standards rather than the often empirical methods of the past. There are still businesses with one-man control which by reason of its circumscribed area of activity limits the development of a business, and there are also cases in which authority is so delegated among a number of executives that unification becomes impracticable and direction and control weakened.

"Laws" and Principles

Executive control is not so much a question of formula as it is of principle, nor is it so much a matter of academic or technical distinction as of capable and practical personality. We talk loosely of "laws" of management or of control as if it were subject to theories which had been worked out and charted throughout the whole course of industrial activity. These alleged "laws" are based on narrow conclusions which have been drawn from a certain set of conditions or certain specific circumstances and not from a broad survey of the management field as it covers general industrial needs. That some of these "laws" are obvious and are truisms is not denied, but they are dangerous in that they legislate for the particular in industry and avoid the main problems of management altogether.

It is frequently the case that those who exercise supreme control over businesses have not had the training which the modern idea of "management" presupposes, and sometimes such controllers are found exercising a wise and beneficent influence over an industry or trade quite foreign to that in which the main portion of their lives has been spent. It is as unfair to assume that ability to control is just a flair, for competence must be accompanied by vision and imagination tempered with a keen sense of proportion and perspective. There must be the ability to appreciate the significance of detail and yet not allow it to obscure the mind to the exclusion of the big things. Quick decision bred of an ordered and analytical mind must be coupled with the cautiousness which appraises risk and a judgment capable of distinguishing between what is vital and what is not. Even with these attributes a man may find himself unable to exercise full control.

Taylor described what he called the "exception principle" as that which permits only those things to come to the attention of an executive which are irregular and demand his immediate consideration. On the other hand, many hold that control by exception is superficial and can only be effective when an executive is supported by a very highly skilled band of subordinates and where with set policies and little chance of variation a business is developing along mechanical or defined lines.

Delegation of Responsibility

It is vitally important that an executive should be able to relieve himself of a mass of detail and of detailed supervision leaving himself free to devote his thoughts and energies to the prosecution of vital activities, to a study of development and to thinking about his business problems and not forgetting the relationship of his own problems to those of other executives in the same business and, beyond, in the same industry.

Too often executives overload themselves with detail and thus not only impose serious limitation on their own efficiency, but, often unwittingly, rob subordinates of the sense of initiative and responsibility and fail to forge equally strong links in the chain of organisation. As a result there is no sequence of control, no provision for emergency, and no elasticity of control to permit of expansion. It is a mistake to concentrate too much on the administrator and forget the administration. While it is true that individual leadership can make or mar an organisation it should be the aim to ensure control through a grouping of forces as a composite result through routine practice than as a single force autocratically applied.

Perfection in management comes from the "routinisation" in the area of executive decision itself, where administration routine is so evolved that standards are set all along the line operating in logical sequence and capable of measurement at any point. It is achieved when the procedure is from the chief executive to successive subordinate executives, where policy is distributed through individual functions and translated into administrative and routine orders exemplified by explicit instructions to factory, warehouse, office, and so on, or from output to consumer. At the same time these individual translations of policies must be capable of speedy co-ordination through committees or boards of directors.

Reports and Standards

Fundamentally two things are necessary to aid control—reports and standards. The common mistake with reports is that they merely give a superficial indication of somewhat obvious conditions and do not provide any clue to underlying factors which may affect such conditions, and it must be complained against standards that in many cases they are so arbitrarily made that they fail to set up a maximum and minimum point beyond which it is dangerous to proceed. Standards which are based only on average conditions and performances neglect the possibility that things above the average may be as dangerous as those below average and they trap the unwary into the belief that all is well while averages are being kept when really the situation is quite the reverse due to abnormal factors which the standard fails to measure.

Where control is exercised on the spot it may be possible to adjust standards so that periodical variations in conditions are allowed for but here the disadvantage is that the standard is no longer a standard. If "management at a distance" is to be exercised the importance of a true standard and its related reports cannot be too strongly emphasised. I can recall a case in which very accurate reports of machine output were sent from the works in the Midlands to the head of the business in London at the end of every day and were accompanied by records of stocks and deliveries; but somehow the output did not reach quota and after some period of correspondence and analysis of reports it was decided that someone must go up to the works and endeavour to find the cause of the inefficient production. The investigator happened to be watching a machine and commented on the extraordinary complication of the press tool being used and hazarded a guess about its probable high cost. A thought flashed through the mind of the works manager. Why was not a Tool Operation Schedule kept? It was started at once and within a short time it disclosed the fact that these tools were being used irregularly, one would be in use for three or four weeks, another only for a few days, and of course the hardest worked tools slowed down output after a certain point.

It seems a small matter and one that should have had an obvious bearing, but the fact remains that the absence of this one report made all the others merely indicative of condition and not causes.

Incomplete Information

Many of the reports regularly presented to executives are really of little value from a detection point of view and they need pruning and in some cases scrapping altogether and replacing with more concise and vital records. For example, a daily report showing orders received and orders executed needs a supplementary record explaining the state of orders in progress and how much before or behind schedule are the orders executed. The most carefully prepared record of machine output and man and machine hours worked and idle is of little value without a relative report on the causes of the idle time. At the same time periodical statistics however accurate and detailed are practically valueless without a standard or index figure for comparison and, to go even farther, the comparisons then made may be false unless the figures employed are weighted to balance out any abnormal situation which may affect certain of them.

It is not true to say that because the June output is 8 per cent. up on that of May, and July is 6 per cent. up on June, that the factory is more efficiently run and therefore there is no need to worry. It may have been that in June and July some special condition operated to give this extra output which was quite foreign to the normal factory conditions and a reason has to be found and the extra output figures weighted to even out the advantage of the special condition to make possible a comparison with normal conditions. It might then be found that without these special conditions the June and July outputs would have been below May and the factory was not working efficiently at all.

Legal

IN the King's Bench Division recently Mr. Justice Lawrence commenced the hearing of an action by Radiovisor (Foreign and Colonial), Ltd., against Radiovisor Parent, Ltd., claiming £200,000 damages and the return or cancellation of 120,000 £1 shares by the defendant company. Defendants denied any misrepresentation in the disposal to plaintiffs of foreign rights in a selenium light bridge.

Sir Wm. Jowitt, in opening the plaintiffs' case, stated that the company was formed at the end of 1928 to take over these foreign rights. It had a capital of £450,000 in £1 shares, of which 380,000 were issued and fully paid. Its purpose was to manufacture a selenium light-sensitive bridge which was expected to be made by mass production. Sir William explained the nature of selenium and its possible applications, which included burglar alarms, street lighting control, &c.

Before the plaintiff company was formed many experiments were witnessed at the defendants' laboratories and the whole situation was repeatedly discussed. The plaintiffs paid £80,000 to the defendant company for the foreign rights in the selenium bridge and made to them an allocation of 120,000 fully paid shares.

Counsel said it was only when the plaintiffs took the apparatus to show to the A.E.G. and the Siemens Co. in Germany, in August, 1929, that they began to have doubts whether the representations of what the bridge would do were all true. The Siemens Co. commented unfavourably on the compensated bridge and it was now known that the " wanderings " of the bridge were not due to temperature alone.

A mass of technical evidence was called and on May 13th the hearing was adjourned till May 24th, when the Courts resume sitting after the Whitsun vacation.

St. James' Co. Appeals Against Assessment

In a King's Bench Divisional Court on May 11th and 12th, the Lord Chief Justice and Justices Avory and Macnaghten had before them an appeal by the St. James' & Pall Mall Electric Light Co., Ltd., from a decision of the Assessment Committee for the City of Westminster, that the valuation of the company's premises for rating was not to be reduced below £89,922 gross and £44,961 net value. The company contended that it was entitled to have taken into account annual payments to sinking funds set up by statute in order that the undertaking might be transferred without charge in 1971 to the London & Home Counties Joint Electricity Authority.

The matter came up as a special case stated under Section 40 of the Valuation (Metropolis) Act, 1869, by order of Mr. Justice Charles.

Mr. Wilfred Greene, K.C., for the company, stated that the Assessment Committee had reduced the valuation of the company's premises from £110,000 gross and £55,000 net value, to £89,922 gross and £44,961 net value. He contended that it should be reduced to £72,664 gross and £36,332 net value. There was no dispute as to the figures, the only question being one of principle. That involved the question of what a hypothetical tenant would give. The company submitted that in taking that basis the hypothetical tenant would take into account what the company had to set aside each year out of revenue for the purpose of the two sinking funds established by statute.

Mr. T. Jones, K.C., for the Assessment Committee, submitted that the case rightly understood was perfectly plain. The company was purchased by the L.C.C. in 1931, on certain terms. These were that in future the company was limited as regarded its dividends—it was not to pay more than a certain dividend unless its price was reduced below a certain standard price—and in 1971 it was to hand over its assets, free of charge, except those bought after 1925, and there was a statutory obligation to provide a sinking fund which, at the end of the period, would not then be represented by visible assets.

That sinking fund was to be provided out of the receipts. It was clear that the revenue in question came from the undertaking to supply electricity. The tenant would return a certain proportion and hand the residue over to the landlord. It would not matter to the tenant what the landlord did with the money when it came into his hands. Therefore, Counsel contended, the Assessment Committee had arrived at a right conclusion.

After Mr. Wilfred Greene had replied the Court reserved judgment.

Lamp Shade Infringement Action Settled

In the Chancery Division on May 12, before Mr. Justice Maugham, a settlement was announced in an action by Louis Dernier & Hamlyn, Ltd., electrical manufacturers, against Albion Shades, Ltd., to restrain the alleged infringement of plaintiffs' registered designs for lamp shades and they also claimed damages.

Mr. K. E. Shelley, for the plaintiffs, now stated that the action had been settled and that the terms had been reduced to writing, and all he asked his Lordship to do was to make the agreed order which was simply for an injunction and costs. Mr. E. B. Stamp, for the defendants, said he consented to the order being made, and his Lordship concurred.

Parliamentary

(BY OUR SPECIAL REPORTER)

ON May 9th Mr. Mander asked the Postmaster-General if he was aware of the nuisance caused to residents in certain areas owing to the noise made by trolley omnibuses, in particular in connection with the reception of broadcasting; and whether he would state what steps could be taken to remedy this state of affairs.

Mr. White, the Assistant Postmaster-General, said that complaints were sometimes made of interference with broadcast reception caused by the working of trolley omnibuses. These cases were investigated by the Post Office, in co-operation with the British Broadcasting Corporation, and where possible a remedy was suggested. The Post Office had no statutory power to enforce a remedy, but it did its best to persuade the parties concerned to adopt suitable measures to prevent such interference.

False Economy

On May 9th Sir Philip Dawson asked the Minister of Transport whether anything could be done to impress upon local authorities and public utility undertakings that where capital expenditure was involved in carrying out remunerative works, such as the extension of the electricity supply undertakings and distribution systems, this should be proceeded with as many works of this nature which would otherwise have been carried out had been either postponed or stopped to the detriment of our electrical industry.

Mr. Pybus said he had already stated in a public speech at the British Industries Fair in February that, in his opinion, the development of productive services, such as that of electricity supply, should follow the normal course, and that the Minister of Health concurred in that view. He further expressed the hope that local authority electricity supply undertakings would not do anything to curtail development, but continue to make as rapid progress as possible.

Co-ordination in Scotland

On May 11th Lieut.-Col. Moore asked the Minister of Transport if he could state the number and names of the electricity boards in Scotland which had, since the passing of the Electricity Act, been merged in larger undertakings; and how many electricity mergers it was proposed to have in Scotland to cover the whole country.

Mr. Pybus said that since the passing of the Electricity Act of 1926, no electricity boards in Scotland had been merged in larger undertakings. While authority had been given for the acquisition of a number of smaller undertakings by larger undertakings in different parts of Scotland, he was not aware of any definite proposals for large electricity mergers in Scotland.

The Leatherhead and Caterham Undertakings

On May 13th Mr. Herbert Williams asked the Minister of Transport if he could state whether the sum of £294,000, purporting to be the capital expenditure on the assets of the Leatherhead and District electricity undertaking transferred to the London and Home Counties Joint Electricity Authority, represented the amount of capital originally expended or the amount so expended less depreciation.

Mr. Pybus said he was informed that the company's accounts indicated that the expenditure of £294,000 represented the original cost of assets existing at the date of transfer.

Mr. Williams then asked the Minister whether he could state if the London J.E.A. had purchased the Caterham electricity undertaking and, if so, at what price; and what was the original capital expended on the transferred property and by how much this had been written down.

Mr. Pybus said he was informed that the Joint Authority had not yet purchased the Caterham undertaking, but had made an application to the Electricity Commissioners for their consent to its acquisition. The matter was at present under consideration by the Commissioners, who would announce their decision in due course.

Electricity Bills in Parliament

Last week the North Metropolitan Electric Power Supply Bill passed its third reading in the House of Commons and received a first reading in the House of Lords.

The South Wales Electric Power Bill received the Royal Assent on May 12th.

The Oakham Gas and Electricity Bill was read a third time in the House of Lords on May 10th and received its first reading in the Commons on the same day.

Adjournment and Reassembly

Parliament rose for the Whitsun recess on Friday, May 13th, and will reassemble on Monday, May 23rd.

Business and Industrial Notes

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures

Bradford Council and Local Tenders

A discussion took place at the May meeting of the Bradford City Council on the question of policy in accepting local tenders or outside quotations for municipal requirements. The matter arose on an amendment by Mr. J. E. Haygarth to an Electricity Committee recommendation for the acceptance of an English Electric Co. (Bradford works) tender for three-phase oil-cooled transformers and transformer chamber switchgear, despite the fact that among nine tenders this particular quotation was 7¼ per cent. higher than the lowest tender. The Electricity Committee, it was understood, had been considerably influenced by the desire to give as much work as possible locally to relieve unemployment. Mr. Haygarth contended that this policy, if carried out irrespective of price, was bad in principle in that it was likely gradually to develop a situation in which outside firms would not submit tenders at all. The particular order concerned in the discussion amounted to some £5,000. Alderman J. W. Longley, defending the attitude of the Electricity Committee as its chairman, contended that some of the prices quoted were not genuine prices. Furthermore, the English Electric Co., Ltd., in the past three years had paid the Corporation about £14,000 for electricity and £4,600 in rates, and was entitled to consideration. Mr. Haygarth was proposing to let this contract go out of the city for the sake of a difference in price of £370. The amendment was defeated by 50 votes to 13.

British-made "Sadia" Water Heaters

Over a hundred of the new British-made water heaters are now being produced weekly at the well-equipped factory of Aidas Electric, Ltd., St. Leonard's Road, Willesden Junction, and owing to the large number of orders in hand arrangements are being made to double this output. The new water heater is manufactured throughout from British material with British labour and capital, and several improvements have been incorporated in the design, the recommendations of the British Electrical Development Association having been followed where possible.

A "Kelvinator" Competition

The competition held by Kelvinator, Ltd., at the recent Ideal Home Exhibition has been won by Mr. F. R. Belfrage, Golfer's Club, 2A, Whitehall Court, S.W.1. The prize was awarded for placing in order ten out of sixteen qualifications which must be possessed by the ideal refrigerator.

Registered Electrical Contractors

Applications for registration from the following were accepted by the Executive Committee of the National Register of Electrical Installation Contractors at its last meeting:—

Hemming, J. E., Smethwick.
Bartlett, F. J., & Son (Cardiff), Ltd., Cardiff.
Jones, A., Hartlepool.
Gwilliam Bros., Stourbridge.
Solihull Electrical Services, Birmingham.
Parsons, C., Reigate.
Williams, D. R., Porthcawl.
Rawcliffe & Learoyd, Leeds.
Devon Electric & General Services, Ltd., Staverton, Totnes.
Atkinson, T. W., Stanley, Co. Durham.
Booker & Tarran, Hull.
Down, A., Barnard Castle.
Bromley, J., & Co. (Wellington), Ltd., Wellington, Salop.
Edmondson, N., Waterloo, Liverpool.
Graham, F., Blackburn.
Hall, W. H., Waterloo, Liverpool.

At the same meeting three applications were withdrawn and thirteen were declined.

The "Revo" Cardiff Branch

A short time ago the Revo Electric Co., Ltd., moved its offices at Cardiff to a more commodious building at 31-32, Frederick Street (illustrated herewith). The change has been found advantageous in many ways, since large showrooms are now available for the demonstration of cooking and other apparatus. Larger and more comprehensive stocks of "Revo" goods are held ready for the inspection of the trade and for distribution in the area.

New "Revo" premises at Cardiff

British Overseas Electrical Trade in April

THE beneficial effect of the introduction of import duties and the depreciated value of sterling continues to make itself felt. The Board of Trade returns for April, from which the appended table has been compiled, show that exports of electrical machinery at £409,231 were £59,497 above the March figure, South Africa (£69,614), and Canada (£58,128), being mainly responsible for the advance with increased purchases of £40,140 and £46,614 respectively. Larger shipments are also reported to British India (£53,630, against £50,726) and Australia (£18,060, against £6,396), but declines are recorded in the purchases of European countries (£158,851, against £183,479), Japan (£787, against £937), South America (£13,406, against £20,116), New Zealand (£4,611, against £14,077), and "other countries" (£32,144, against £33,015).

Compared with April, 1931, electrical machinery imports advanced by £34,051, the customers contributing most to the improved state of affairs being European countries (£82,080 increase), South Africa (£41,639 increase), Australia (£14,145 increase), and Canada (£13,024 increase). There were decreases of £24,994, £16,565, £27,528, and £47,523, respectively, in the shipments to South America, British India, New Zealand and "other countries."

	Exports.			Imports.			Re-Exports.		
	Electrical exports for April, 1932.	Inc. or dec. as compared with March, 1932.	Inc. or dec. as compared with April, 1931.	Electrical imports for April, 1932.	Inc. or dec. as compared with March, 1932.	Inc. or dec. as compared with April, 1931.	Electrical re-exports for April, 1932.	Inc. or dec. as compared with March, 1932.	Inc. or dec. as compared with April, 1931.
Insulated wires and cables	£79,736	− £16,197	− £34,794	£17,668	+ £924	− £43,479	£604	+ £419	+ £234
Electric carbons	7,398	+ 6,254	+ 6,575	5,461	+ 2,427	− 9,193	45	− 14	− 332
Arc lamps and searchlights	985	+ 768	+ 803	628	+ 628	+ 523	99	− 35	− 34
Incandescent lamps	28,596	− 1,499	− 2,316	8,259	− 1,440	− 12,413	239	− 260	—
Other lighting apparatus	26,557	+ 3,667	− 4,809	12,954	− 2,798	− 19,936	1,037	− 905	+ 1,115
Batteries and accumulators	68,268	+ 19,504	+ 18,237	3,228	− 3,526	− 28,493	1,577	− 14,803	+ 1,261
Meters and instruments	28,235	− 11,390	− 1,254	21,611	− 5,898	− 4,336	417	− 315	+ 58
Unenumerated goods and apparatus	85,154	− 6,820	− 55,810	41,135	− 392	− 29,911	3,769	+ 1,469	− 322
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cables (not submarine)	30,443	+ 11,780	− 23,809	97	− 575	− 3,025	—	− 261	− 42
Submarine telegraph and telephone cables	761	− 1,862	− 9,653	—	—	—	—	—	—
Telegraph and telephone apparatus	122,100	− 16,020	− 88,920	31,874	− 6,390	− 82,851	8,613	+ 4,548	+ 233
Electrical Machinery—									
Railway and tramway motors	5,931	− 4,330	− 14,028	—	—	—	—	—	—
Other motors and generators	116,526	− 12,459	− 44,182	—	—	—	—	—	—
Unenumerated electrical machinery	286,774	+ 76,286	+ 92,261	53,115	− 29,231	− 65,787	7,836	− 4,213	− 1,819
Total	£887,464	+ £47,682	−£161,699	£196,030	− £46,271	−£298,901	£25,136	−£14,370	+ £352
Decreases for the first four months of the year		Exports. £1,318,636			Imports. £922,939			Re-exports. £24,025	

An Inquiry from Australia

A Sydney (N.S.W.) company of electrical suppliers informs us that it is anxious to get into communication with manufacturers of electrical and radio goods with a view to representing them in Australia on a commission basis. The company states that it is already an agent for several English factories and it desires to increase its English business. The lines in which it is principally interested are: All wiring accessories, non-Association wires and cables, lamps, friction tapes, all radio apparatus and insulation material. Our correspondents say: "At present it is very hard to obtain direct indent orders, and until business becomes normal we are prepared to carry stock in Australia." It is emphasised that only *sole* agencies for Australia are required. We shall be pleased to put any of our manufacturer readers into touch with this company.

Battery Operating Hints

A useful little booklet has just been published by Messrs. Pritchett & Gold & E.P.S. Co., Ltd., 50, Grosvenor Gardens, S.W.1, entitled "Battery Operating Hints." Methods of treatment and operation are dealt with in detail, the sections on repairs and maintenance being particularly helpful.

I.F.S. Radio Duties

Under the Irish Free State Budget a duty of 50 per cent. *ad valorem* has been imposed on radio sets and parts imported into the country. Representatives of the radio trade in Dublin have declared that if the radio business was bad before, this new tax would kill it. There would probably be a rush of business during the next few weeks for goods at standard prices, but then there would be a stoppage. It was not thought that the new duties would result in any factory being started in the Irish Free State, as the volume of trade would not be sufficient for the purpose, unless such a factory were given a monopoly.

Municipal Showroom Sales at Eccles

The Corporation Electricity Committee proposes that in future trade discount on articles sold in the Electricity Department's showroom shall only be allowed to local contractors where sales have been effected as a result of their introduction of the business.

A Wolverhampton Window Display

Considerable interest has been centred in a special display (shown below) of "Governor" and "Trojan" electrical appliances in the main window of the Wolverhampton Electricity Department's showrooms. The whole of the appliances displayed (with the exception of the lighting fittings) were

A display of "Governor" and "Trojan" appliances

manufactured at the Wolverhampton works of Messrs. John Shaw & Sons (Wolverhampton), Ltd. These works were reorganised some time ago to arrange for the manufacture of electrical appliances, and plans are now well advanced for the extension of the existing factory to give additional manufacturing facilities.

Soviet Government Acquires A.S.E.A. Russian Works

The works established by the Allmänna Svenska Elektriska A.B. at Yaroslaff, on the Volga, have been sold to the Soviet authorities for the sum of $7,700,000, mainly in the form of 8 per cent. dollar bonds. Mr. A. Linden, who conducted the negotiations in Russia, is reported to have stated that when the Swedes obtained the concession the Russians sought to encourage foreigners to accept concessions, but now they desire to attend to everything themselves. In view of the situation the agreement was quite satisfactory. Mr. Linden also said that during recent years the Swedish company had received dividends on its shareholding and the deliveries to Russia from Sweden had also yielded a profit. In conclusion, he remarked that the agreement did not imply that the A.S.E.A. would be excluded from the Russian market; it would continue as hitherto to carry on business direct with that country.

Iron Trades Employers' Insurance Association

The annual general meeting of the Iron Trades Employers' Insurance Association, Ltd., was held on May 5th, Sir Frederick Henderson presiding. In spite of the fact that 103 firms with wages bills totalling £7,041,762 were added to the company's books during the year ended December 31st last, the premium income declined by £131,278 to £542,258. There was a credit balance of £178,212 on the net revenue account.

British Plant for Iraq

With reference to the note which appeared under this heading in our last issue we understand that the contracts for the scheme for a public lighting installation for the town of Mosul have been placed with Malcolm and Allan, Ltd., the Brush Electrical Engineering Co., Ltd., and Callender's Cable and Construction Co., Ltd.

Malayan Electrical Imports

The value of electrical goods and apparatus imported into Malaya during 1931 totalled $4,229,398, as compared with $5,059,030 in 1930.

Polish Electrical Trade

Converting the zloty at 32¼ to the £, imports of electrical machinery into Poland last year amounted to £461,530, as compared with £615,385 in 1930. There was also a decline during the same period in the imports of electrical equipment, including radio, from £2,184,615 to £1,384,615.

Social Events

The Leeds Electrical Club and the Sheffield Electrical Club have arranged cricket matches at Roundhay Park, Leeds, on June 9th, and at Hathersage, Sheffield, on July 7th.

The International Tube Cartel

According to *The Times*, at a recent meeting of the International Tube Cartel, at Prague, it was arranged that no more Continental gas, water and steam tubes would be imported into Great Britain.

For Sale

Sunderland Electricity Department invites tenders for the purchase of d.c. plant.

Leicester Electricity Department has a quantity of electrical plant for disposal.

(See our advertisement pages to-day.)

Price Reductions

Messrs. Ferranti, Ltd., announce that they are reducing the prices of their electric fires.

Trade Announcements

As a result of considerable confusion that appears to have arisen, the Autocar Electrical Equipment Co., Ltd., points out that its correct addresses are:—Albert Embankment, S.E.11, and Green Lane, Goodmayes, Ilford.

The British Engine, Boiler & Electrical Insurance Co., Ltd., has removed its Glasgow office to Commercial Buildings, 98, West George Street, Glasgow, C.2, and the telephone number has been changed to "Douglas 2336 and 2337."

Walsall Conduits, Ltd., are opening a new branch on May 23rd at 32A, Albert Road, Reading. Telephone, "Reading 2989."

Messrs. V. A. Bellamy & Co., electrical engineers and contractors, of Douglas, Isle of Man, have removed to Ridgeway Chambers, Ridgeway Street.

The Scottish Electric and Engineering Co. is moving next week to new premises more centrally situated at 163, Seagate, Dundee.

The Publicity Department of Lancashire Dynamo and Crypto, Ltd., has moved from Trafford Park to new offices at 94, Petty France, S.W.1, where the publicity activities of the combined companies will continue to be conducted under the direction of Mr. W. L. Allison. The new "home" is in a large suite of modern offices, which is also occupied by the sales organisation headquarters.

Prices of Materials

Messrs. F. Smith & Co. report, May 18th: Electrolytic copper bars, £36 10s., £1 dec. Ditto ditto sheets and h.c. wire, no change. Ditto ditto wire rods, £40 10s., £1 dec. Silicium bronze wire, no change.

Messrs. Edward Till & Co. report, May 18th: India-rubber, Para fine, no change.

Messrs. James & Shakespeare report, May 18th: No change in the prices of copper bars (best selected), sheet and rod, and English pig lead.

Standard Wiring Symbols

The list of graphical symbols just issued by the British Standards Institution in B.S. Specification No. 447, 1932, should be of considerable assistance to architects, consultants, and contractors concerned with installation work. The standard symbols now recommended have been drawn up with the co-operation of the Architectural Association, the Association of Consulting Engineers, and the Electrical Contractors' Association. They enable complicated installations to be planned without resorting to the use of coloured pencils or ink, and

without covering the plan with a maze of letters and figures. Where practicable, each sign has some slight resemblance to the device which it is intended to represent, and the employment of letters has been deliberately avoided mainly on the ground that their use might prejudice the eventual adoption of the symbols internationally. The symbols are conveniently arranged on a single sheet which can be cut out of the booklet and stuck on a card for hanging on the wall. Copies of this Specification (No. 447-1932) can be obtained from the Publications Dept., British Standards Institution, 28, Victoria Street, S.W.1., price 1s. 2d., post free.

Recent Contracts

An order has been placed with the English Electric Co., Ltd., by the Galloway Water Power Co. through its consulting engineers, Messrs. Merz & McLellan, for five large water turbo-alternator sets and three auxiliary sets for the Tongland and Glenlee power stations, together with a considerable quantity of switchgear and transformer. The water turbines will be constructed at the company's Rugby works, and form the largest order for this class of product so far undertaken in that factory. The generators and other material will be made at the Stafford Works. Other recent orders received by the company for power station plant include a 7,500-kW turbo-alternator set, a repeat order for a 3,750-kW set, and a 900-kW pass-out turbo-alternator, all for industrial concerns in the South of England; in each case condensing plant is being supplied. The total value of the above-mentioned contracts approximates to £350,000.

The General Electric Co., Ltd., have received a contract from the Kailan Mining Administration for the power plant equipment for the new coal-handling plant built at Lung Hua, on the Whangpoo River about four miles from the centre of Shanghai. Electric power is obtained from two 750-h.p. Allen high-speed vertical compound reciprocating steam engines direct-coupled to two 500-kW, 440-V, d.c. compound-wound generators. Transmission is through underground cables from the main switchboard situated in the power house, to a sub-station underneath the screening plant. From this sub-station, feeders go out to the unloader issuing tower, travelling bridges, screening plant, belt conveyors, and other equipment. In all fifty-two motors were supplied by the G.E.C., ranging from 130 h.p. down to 3 h.p. For lighting two 30-kW Allen steam engines and G.E.C. generators have also been installed. Floodlighting projectors have been placed on the unloader, issuing tower, and travelling bridges for night operation. It is estimated that 550,000 tons of coal will pass through the depôt yearly.

In 1930 Messrs. Clarke, Chapman & Co., Ltd., installed at the Crown Wharf, Deptford, belonging to Messrs. Cory & Son, Ltd., a new ropeless type of level luffing gear. This order has proved satisfactory and has been followed by a repeat order for a duplicate crane at the same wharf, the two cranes being shown in operation in the accompanying picture. They each have a maximum working load of four tons and maximum radius 56 ft., with a lifting speed of 250 ft. per min. The new level luffing arrangement depends in principle upon a system of levers through which the jib of the crane is

Clarke, Chapman level luffing cranes at work

balanced by means of a counter weight. As a result of this system unusually good control, even at the extreme position, is obtained, a high speed of working is ensured, and rope replacement is reduced to a minimum. Messrs. Clarke, Chapman & Co., Ltd., are also engaged in an interesting contract for four 5-ton level luffing cranes on the Mole, at Gibraltar, each crane being mounted on a transporter bridge 118 ft. long, the total erection in each case being approximately 100 ft. high.

A Bright Suburban Cinema

The floodlighting of the Granada Cinema, Mitcham Road, Tooting, was completed recently, and a view of the building is reproduced herewith. The exterior of the building is illuminated by means of 1,000-W "Mars" projectors fitted with "Ediswan" lamps, fitted in the canopy, and "Neptune" projectors fixed at the top of the building. The car park is illuminated by "Mazdalux" rectangular angle reflectors which are mounted on brackets on the wall. Small "Swan" ball fittings have been installed in the cloakroom, and brightness

The Granada Cinema, Tooting

has been added to the proscenium opening by the use of cornice lighting strip; stained glass windows at either side of the proscenium are lighted by means of inverted rectangular angle reflectors on adjustable brackets.

New Catalogues and Lists

Aidas Electric, Ltd., St. Leonard's Road, Willesden Junction, N.W.10.—A price list of the new British-made "Sadia" water heaters.

Fry's (London), Ltd., 24-25, King Street, Minories, E.1.—A leaflet describing "Brasso" double-edged hack-saw blades.

Benjamin Electric, Ltd., Tariff Road, Tottenham, N.17.—April issue of "The Reflector," containing an article on the new Ford works at Dagenham, &c.

B.E.N. Patents, Ltd., 92, Tottenham Court Road, W.1.—An illustrated folder relating to air compressors.

D.P. Battery Co., Ltd., Bakewell, Derbyshire.—A 32-page booklet illustrating and describing "Kathanode" cells for traction purposes. Also a leaflet on batteries for operating cinema sound equipment.

Power Plant Co., Ltd., West Drayton, Middlesex.—A booklet of graph paper, together with a calendar.

Feed Water Specialists Co., St. Paul's Square, Liverpool.—Technical publication No. 45, containing notes on coal, steel, alkalinity and corrosion. Also a diary for May and June.

Cox-Walker, North Eastern Electric Works, Darlington.—A leaflet on electric bells.

Lunken Co., Ltd., 35, Great Dover Street, S.E.1.—An illustrated catalogue of improved hand tachometers and tachographs.

West Central Engineering & Supply Co., Ltd., Kenton Street, Russell Square, W.C.1.—A 90-page catalogue of stock sizes of iron and steel sections and alloy steels.

Korting & Mathieson Electrical, Ltd., 711 and 715, Fulham Road, S.W.6.—The "Kandem Quarterly Review," giving an insight into some of the activities at the Kandem Works.

Heyes & Co., Ltd., Water-Heyes Electrical Works, Wigan.—The May number of the "Wigan Review," containing details regarding the construction of "Wigan" prismatic lighting fittings.

Bankruptcy Proceedings

R. Dring, electrical engineer, 257, Freeman Street, Great Grimsby, and 52, High Street, Cleethorpes.—This debtor applied for his discharge on May 11th, at the Town Hall, Great Grimsby. The Official Receiver stated that the debtor was adjudged bankrupt in July, 1930. Liabilities estimated at £2,553 actually amounted to £2,657, and assets estimated at £1,542 produced £1,136. A first and final dividend of 5s. 3½d. in the £ had been paid. The position was attributed to lack of capital and depreciation of stock through falling prices. It was also stated that the assets were not equal to 10s. in the £, and that the debtor had contracted liabilities for substantial amounts, where there was no reasonable chance of repaying them. The discharge was granted, subject to suspension for nine months.

H. V. Clark (trading with another as Magson, Clark & Co.), electrical engineer, 165, High Street, Hornchurch, and at South Benfleet, Essex.—This debtor's application for discharge was heard at the Shire Hall, Chelmsford, on May 9th. The Official Receiver reported that the liabilities had amounted to £1,307, and the assets, which had been estimated at £416, had produced £57, and a further £10 would probably be realised. No dividend had been paid to creditors. Debtor said that he had control of the business at South Benfleet, but knew little about the Hornchurch concern. The Judge granted the discharge with a suspension of four months.

Hilton Garrett & Co. (other than J. B. Garrett), dealers in electrical supplies, 123, Queen's Road, Brighton, Sussex.—The receiving order was made recently, and according to the statement of affairs filed the liabilities amount to £1,159 and the assets to £371, leaving a deficiency of £789. The separate estate of Claude H. Garrett shows ranking liabilities of £36 and assets of £4. The failure is attributed to "want of capital,

bad trade, and overstocking." At the first meeting of creditors held recently, Mr. A. E. Orbell, 6-7, Old Steine, Brighton, was appointed trustee, with a committee of inspection.

A. Whitelock, wireless dealer, Tholthorpe, Yorkshire.—Receiving order made May 10th, on debtor's own petition.

S. H. Holly, electrician, 4, South Street, Wareham, Dorset.—Last day for receiving proofs for dividend, May 31st. Trustee, Mr. F. H. Langmaid, Mid.and Bank Chambers, High Street, Southampton.

H. C. Scholes (trading as Scholes Electric Co.), 72, High Street, Sidcup).—Last day for receiving proofs for dividend, May 31st. Trustee, Mr. C. J. Pyke, Official Receiver, 280A, High Street, Rochester.

B. Marsh, electrician, 17, Victoria Road, Brighton.—Second and final dividend of 2s. 1d. in the £, payable May 20th, at the Official Receiver's offices, 3, Old Steine, Brighton.

G. P. Lambourne, wireless dealer, High Street, Westerham.—Receiving order made May 6th on debtor's own petition.

W. T. Darlington, electrical engineer, 23, Finchley Street, Moston, Manchester.—Application for discharge to be heard on June 27th at the Court House, Quay Street, Manchester.

D. W. Morphy, wireless apparatus manufacturer, 14, Collinette Road, Putney, S.W.—Last day for receiving proofs for dividend May 28th. Trustee, Mr. E. Parke, Official Receiver, Bankruptcy Buildings, Carey Street, W.C.

Company Liquidations

Barrett & Morris, Ltd., wireless and electrical dealers, High Street, Camden Town, N.W.—The statutory meeting of creditors was held on May 10th, at the offices of Messrs. Levy, Hyams and Co., 27, Chancery Lane, W.C. Mr. G. Barrett, one of the directors of the company, presided. The statement of affairs showed ranking liabilities of £2,020, and assets of £245, or a deficiency as regarded the creditors of £1,775. The issued capital was £100. Mr. M. Hyams reported that the company had passed a resolution for voluntary liquidation, and had nominated him to act as liquidator. The business had been closed down. Resolutions were passed confirming the voluntary liquidation with Mr. Hyams as liquidator, and a committee of the principal creditors was also appointed.

Kinetic Wireless & Electric Supplies, Ltd., 5, Godstone Road, Caterham, Surrey, and elsewhere.—The statutory meeting of creditors was held on May 9th at the Institute of Chartered Accountants, Moorgate Place, E.C.2, when one of the directors of the company said that the shareholders had previously passed a unanimous resolution putting the company into liquidation and nominating Mr. Child, of Messrs. Trayton P. Child and Co., Queen Street, E.C., as liquidator. Mr. Child submitted a statement of affairs which showed liabilities of £2,478, all due to unsecured creditors. In addition there were fully secured creditors for £1,386, holding security valued at a similar amount. The net assets were £1,969, leaving a deficiency of £508. It was explained that the assets were subject to realisation and expenses, and consequently the deficiency might be considerably underestimated. It was decided to confirm the appointment of Mr. Child as liquidator, with a committee of inspection consisting of the representatives of three of the creditors.

Dean & Gosling, Ltd.—Winding up voluntarily. Liquidator, Mr. L. J. Cozens, 8, East Stockwell Street, Colchester.

Arnold Goodwin & Son, Ltd.—Meeting, June 22nd, at the company's office, Sumner Street, Southwark, S.E.1, to receive an account of the winding up from the liquidator, Mr. Arnold Goodwin.

Bel-Canto Radio, Ltd.—Meeting, June 20th, at 448, Strand, W.C.2, to receive an account of the winding up from the liquidator, Mr. R. S. Andrews.

Private Arrangement

Independent Battery Co., Ltd., 272, Camden Road, N.W.1.—A meeting of creditors was held recently in London. No statement of affairs was submitted, but according to a balance sheet dated April 23rd, 1932, the liabilities totalled £6,130. On the other side there was cash in hand and at bank £121, sundry debtors on loan account, £45; trade debtors, £821; stock in trade, £1,026; expenditure in advance, £70; motor vehicles, £465; fixtures and fittings, £58; preliminary expenses, £51; goodwill, £1,564; and there was an estimated loss on trading of £1,910. It was resolved that the representative of the Ever-Ready (Great Britain) Co., Ltd., should be appointed to collaborate with the receiver in disposing of the assets and to endeavour to effect a sale of the business, and further, that the petition which had been filed for compulsory liquidation by one of the creditors should be resisted in order that the creditors might get the benefit of any distribution from a realisation. (The petition mentioned above is to be heard in London on May 30th.)

Dissolutions of Partnership

Premier Armature Repair Co., electrical engineers, 23, Harwood Lane, Great Harwood, and at St. Helens.—Messrs. W. Rothwell and J. Rothwell have dissolved partnership. Mr. W. Rothwell will attend to debts contracted at the Great Harwood branch and carry on the business there, and Mr. J. Rothwell will attend to debts contracted at the St. Helens branch and continue that branch.

G. S. Peckham & Co., electrical and mechanical engineers and manufacturers, 4 and 5, New Compton Street, Charing Cross Road, W.C.2.—Mr. G. S. Peckham, acting by his wife, and Mr. E. A. V. Peckham have dissolved partnership. The latter will carry on the business and attend to debts.

Mount & Willdern, electrical contractors, The White House, East Acton Lane, W.—Mr. C. J. Mount and Mr. E. P. Willdern have dissolved partnership. Mr. Mount will attend to debts.

Winding-up Order

Kinson Electrical Co.—A winding-up order was made against this company on May 9th.

Reduction of Capital

Linley & Co., Ltd.—The reduction of this company's capital from £20,000 to £10,000 was registered by the Registrar of Companies on May 5th.

Electricity Supply

Lighting, Domestic, Power

Aberyswyth.—FUTURE OF ELECTRICITY UNDERTAKING.—The Town Council, after discussing the question of purchasing the electricity undertaking, has decided to ask the company what amount of reduction it is prepared to make in the charges should the Council grant an extension of time for purchase.

Banchory.—STREET LIGHTING.—The Grampian Electricity Supply Co. has informed the Town Council that electricity will be supplied by means of overhead lines for street lighting by September 1st next.

Bath.—OVERHEAD LINE LOAN.—The Electricity Committee has received sanction to a loan of £1,865 for the erection of an overhead line to Upper Swainswick.

Burton-on-Trent.—EXTENSIONS.—The Town Council has been unable to arrange all the necessary wayleaves for the extension from the Anslow line to the Henhurst Hill district, and in consequence an underground main is to be laid from Shobnall Road at an estimated cost of £1,265 in order to give the required supply. Permission is to be sought to supply the premises of the Nestlé and Anglo-Swiss Condensed Milk Co., Ltd., at Sudbury at a cost of approximately £350.

Cannock.—EXTENSIONS DEFERRED.—The Urban District Council has decided not to extend mains to Dunston and Acton Trussell as the anticipated revenue will be only 8 per cent. on the capital expenditure. The Electricity Commissioners are to be asked to give an extension of four years of the period in which the Council is compelled to give its final decision as to the extension.

Cardiff.—HEATING OF HOSPITAL.—The Hospitals Committee has decided to install an electrical panel system of heating at the Llandough Hospital at a cost of £550.

PROGRESS DURING 1931.—Preliminary particulars regarding the operation of the Electricity Department during the year ended March 31st show that sales of electricity were estimated to reach about 47,000,000 kWh, an increase of approximately 4 per cent. over the previous year. Despite general tariff reductions in June last, the revenue was anticipated to be £287,000 as compared with £289,258 last year. Costs were down, particularly for generation, due to lower cost of fuel and increased efficiency in operation of plant, but increased expenditure was incurred in distribution due to the increased number of meters and cookers purchased during the year. The greater output was obtained with about 3,500 tons less coal. Consumers increased by 3,845, as compared with 4,214 the previous year. A very satisfactory surplus on the year's operations might be anticipated.

Carlisle.—MAINS AND SERVICES.—The Electricity Committee is to apply for sanction to a loan of £15,000 for mains and services.

Cheshire.—SUPPLY TO WRENBURY HALL.—The County Council is to ascertain if the North Wales Power Co., Ltd., is in a position to afford a supply to the Wrenbury Hall colony.

East Ham.—HEATING CHARGES.—The Electricity Committee recommend the following reductions in the prices of electricity supplied for heating purposes through a separate meter: 1d. per kWh for the first 200 kWh per quarter, and ¾d. per kWh above that amount.

Edinburgh.—ELECTRIC COOKER PROPOSAL.—The use of smaller electric cookers to meet the requirements of new houses are being considered by the Corporation. The electricity manager reports that the " family " type of cooker, which is the only type offered at present by the Corporation, is in many cases too large for the space available in the kitchenettes of bungalows and other new properties, and he proposes that a smaller size of cooker should be hired at a rental of £1 per annum. The hiring rate for the " family " size is 30s. per annum.

Galgate (Lancaster).—REQUEST FOR SUPPLY.—The village is asking for a supply of electricity from Lancaster.

Glasgow.—CHEAPER COMMERCIAL LIGHTING.—The Electricity Committee recommends that the primary rate for commercial lighting shall be reduced from 5d. to 4½d. per kWh. This concession brings commercial lighting into the same category as the primary rate for residences, and will represent a saving to those concerned of between £40,000 and £50,000 a year.

MAINS EXTENSIONS.—Mains extensions are to be carried out at a cost of £1,418.

Great Yarmouth.—LOANS SANCTIONED.—The Town Council has received sanction to loans of £8,873 for feeder extensions, and £2,500 for transformer plant required in connection with the grid.

EXTENSION OF THE SUPPLY AREA.—The town clerk and the borough electrical engineer are to confer with Norwich Corporation for the transfer from the Norwich to the Yarmouth area of the parishes of Freethorpe, Fishley, Upton, Moulton, Limpenhoe and Southwood.

Halifax.—ASSISTED WIRING.—The Electricity Committee recommends two new schemes of hire-purchase wiring, prepared by Mr. E. A. Mills, the borough electrical engineer. The existing scheme of the Department is for surface wiring only and is restricted to from four to eight points. Under the new scheme No. 1, a householder requiring from eight to sixteen

points, including a plug for an electric iron, may have the wiring on hire-purchase terms with a deposit and twelve quarterly payments; or, if desired, repayment may be extended over twenty quarters. Scheme No. 2 is for plugs only, as additions to existing lighting installations. Plugs, not exceeding four in number, either 5- or 15-A size, will be supplied for a deposit and twelve quarterly payments.

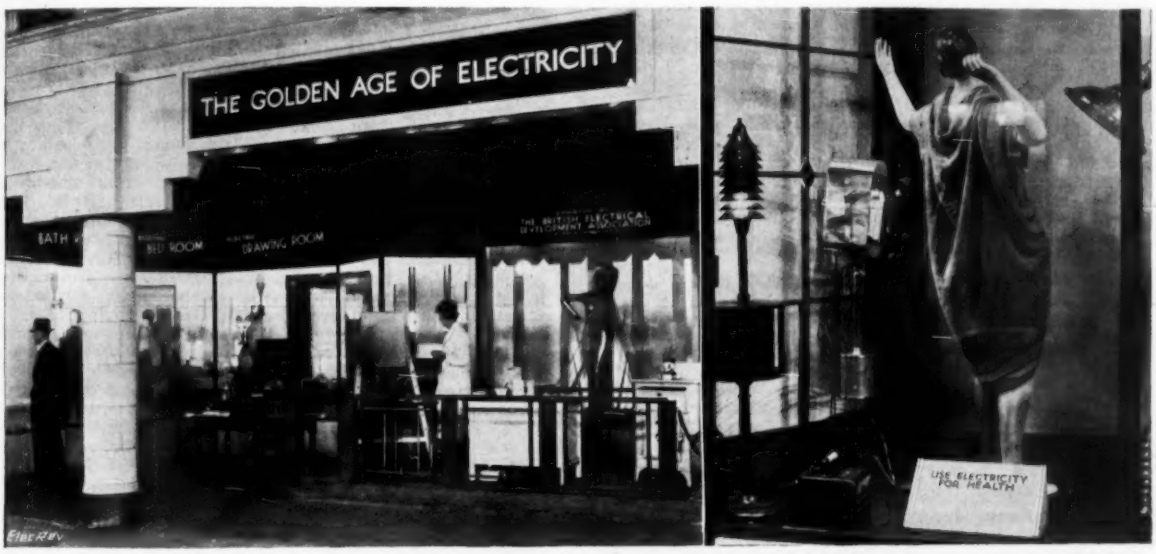
Hastings.—HIRE CHARGE REDUCTIONS.—The Electricity Committee recommends various reductions in hire charges for cookers and heaters.

EXTENSIONS.—Arrangements have been made for the extension of mains at a cost of £11,340, and the provision of substation buildings and equipment at a cost of £6,085.

Hellingly (Sussex).—LIGHTING OF THE COUNTY HOSPITAL.—The East Sussex County Council has asked for a grid supply for lighting the County Mental Hospital at Hellingly. The estimated cost of receiving the supply is £710.

India.—THE TUNGBHADRA SCHEME.—Full investigation of the Tungbhadra scheme, which proposes the construction of a gigantic dam to impound water whereby more than a million acres of land will be cultivated, has now been carried out by the Madras Government. The dam will be utilised for the production of hydro-electric power also. The total cost of the scheme is estimated at Rs.32 crores. The report of the investigation by the Madras Government has been sent to the Nizam's Government for its views.

A SUPPLY FOR GUJERATH.—A proposal is being discussed to utilise the falls on the Narbada River in Gujerath for the production of electrical energy to supply the Ahmedahad cotton mills as well as the rest of Gujerath. The Narbada is one of the most important rivers of India; it is 800 miles long.



Much attention is being attracted by this E.D.A. exhibit at the Charing Cross "Underground" station. On the left is a general view of model all-electric rooms, while the right-hand picture shows the demonstration of artificial sunlight apparatus

Lichfield.—OVERHEAD LINE.—The City Council has decided to erect an 11,000-V overhead line from Alrewas sub-station, *via* Orgreave, to King's Bromley, with the necessary l.p. distributing lines, transformers and isolating gear, at a cost of £2,114. It has also been decided to provide a duplicate overhead 33,000-V main from Aldridge to the Beacon Street substation at a cost of £4,950.

Liverpool.—THE CLARENCE DOCK STATION.—A dispute between the Corporation and one of the contractors for the Clarence Dock power station as to the exact interpretation of certain guarantees, having been given a somewhat sensational interpretation in certain newspapers, the town clerk last week issued a statement making it clear that the final cost of the station would not be £8,000,000, as had been stated, but £5,800,000. Counsel's opinion has been taken on the matter in dispute, which concerns only one section of a particular contract. The statement says that "not only is the building perfectly safe, but also all the machinery contained in it and the sense of responsibility of the officials is much too great for them to permit any plant being used, if there was the slightest danger to anyone, either the public or staff. The station is proving extremely efficient and is generating at the lowest cost of any in the country."

London.—BERMONDSEY.—The Borough Council has received sanction to loans of £10,000 for mains and services and £5,000 for meters.

KENSINGTON.—A petition signed by over 2,500 persons is to be presented to Parliament protesting against the prices charged for electricity by the Kensington & Knightsbridge Electric Lighting Co., Ltd.

Lyme Regis.—CHEAPER ELECTRICITY.—The Town Council has reduced its electricity charges from 1s. to 10d. per kWh for lighting and from 4d. to 3d. for power.

Manchester.—PROGRESS DURING MARCH.—During March the Electricity Department showed an increase of 18,830 kW in connections, making a total to date of 496,017 kW. Applications for supplies, including additional supplies, amounted to 1,652, representing a total of 3,991 kW. There were 235 new cookers installed, bringing the total now on circuit to 9,386, while orders received for the hire of cookers totalled 205. New plant was installed at three existing sub-stations.

Manchuria.—ELECTRICAL CONSOLIDATION SCHEME.—There are at present some sixty electric power companies in Manchuria. *Eastern Engineering and Commerce* states that the recently established Government proposes to consolidate these into one great power trust with capital exceeding $100,000,000. It is estimated that this scheme for the electrification of the whole of Manchuria will take at least five years to complete. South Manchuria will have the existing power station at Fushan, which will serve the whole of that territory, while in North Manchuria a modern power plant will be constructed at Harbin with overhead lines to the outlying districts.

Norwich.—LOANS.—The Electricity Committee is to apply for sanction to loans of £16,330 for additions and alterations to switchgear, £41,000 for overhead lines in the rural area, and £2,135 for step-up transformers and switchgear.

Oswestry.—LOANS SANCTIONED.—The Town Council has received sanction to a loan of £1,600, portion of a sum of £2,225, for extensions to Llanymynech, Pant and Carreghofa, and also to a loan of £1,500 for other electrical purposes.

Retford.—RANSKILL ASKS FOR SUPPLY.—The Rural District Council has received a request from the parish of Ranskill for a supply of electricity.

ELECTRICAL SCHEME FOR INSTITUTION.—The Notts County Council has authorised the installation of electricity throughout the Retford Institution at a cost of £200.

Saddleworth.—PUBLIC LIGHTING.—The Lighting Committee has agreed to change over the public lighting in Diggle from gas to electricity if the Joint Electricity Board will supply electricity for the use of Diggle residents.

Scarborough.—LOANS SANCTIONED.—The Electricity Committee has obtained sanction to borrow £40,000 for mains and services and £10,000 for domestic apparatus.

Shrewsbury.—YEAR'S WORKING.—The Electricity Committee records a net profit of £1,791 for the past year's operation of the electricity undertaking.

South Africa.—GRAAFF-REINET.—The Town Council has been informed by the Public Debt Commissioners that they are unable to grant a loan of £20,000 for the new electrical plant. The scheme has been sanctioned by the ratepayers, the provincial authorities, and the Electricity Commission, and the new machinery is urgently required, as part of the present plant has broken down.

Spalding.—COUNCIL HOUSE INSTALLATIONS.—The Urban District Council has appointed a sub-committee to consider the advisability of installing electric lighting in Council houses under the assisted wiring scheme.

Stafford.—SUPPLY IN NORTHERN AREA.—The Electricity Committee has decided to purchase a second-hand rotary convertor, costing £500, to meet the requirements of consumers in the north of the town. The total cost of the scheme is between £1,500 and £1,800.

Tow Law (Durham).—COMPLAINT AGAINST POWER COMPANY.—The Council has resolved to make a complaint to the Ministry of Transport about what it describes as the high-handed action of the Newcastle-upon-Tyne Electric Supply Co., Ltd., over

the supply of electricity to its area. The company has arranged for supplies to parts of the area, but with respect to other parts it declines to proceed unless the Council will enter into an arrangement with respect to street lighting. This the Council refuses to do, as it considers that it would involve a surrender of its control of the streets. The Council takes the view that under the terms agreed to it can force the company to install electricity throughout the area without any of the compensating advantages which the company claims.

Wigtownshire.—WORK TO BEGIN IMMEDIATELY.—Messrs. Watsham's, Ltd., with whom has been placed the contract for the erection of transmission lines to supply electricity throughout Wigtownshire, are to begin work immediately. Newton Stewart will be the headquarters until the contract is completed.

Winchester.—DEVELOPMENT SCHEMES.—The City Council has received sanction to the borrowing of £7,000 for mains and services, and to the using of £1,496 unspent balances of loans sanctioned for general extensions of mains and services. The Housing Committee has approved terms for giving a supply of electricity to eighty houses on the Highcliffe Park Estate.

Traction

Continental—SPAIN.—The suburban line from Bilbao to Portugalete is at present being electrified at 1,500 V d.c.

ITALY.—A new electric railway has recently been completed and opened for traffic between Rimini and San Pellegrino, a distance of about 20 miles.

HOLLAND.—It is announced that the annual Congress of the Union Internationale de Tramways de Chemin de Fer d'Interêt Local et de Transports Publics Automobiles is to be held at The Hague from June 26th to July 4th next. Among the papers to be read at the meetings are one by M. Bacqueyrisse and M. Mattersdorf, of Paris, on "Traction Motors and Recuperation"; one on "Trolley-bus Working" by M. Ch. Harmel and M. R. Vente, and one on "A Comparison of Public Transport Systems—Local Railways, Tramways, and Motor Buses" by M. P. Jourdain. Full particulars of the Congress can be obtained from the organising secretary at 112, Rue du Trone, Brussels.

Glasgow.—TRAFFIC SIGNAL EXPERIMENTS.—The Streets and Buildings Committee recommends the erection as an experiment of a complete set of "Electromatic" vehicle-operated traffic signals at an estimated cost of £350.

Great Western Railway.—NEW SIGNALS.—All semaphore signals on the company's system are to be replaced by electric lights. These will have one bulb showing orange, red or green, whereas the present lights have one for each colour.

Japan.—RAILWAY ELECTRIFICATION.—It is understood that about a million yen is to be spent on completing the Ryogoku-Ichikawa section of the I.G.R.'s Sobu line.

L.N.E. Railway.—LIGHT SIGNALS.—The section of the London & North Eastern Railway between Finsbury Park and Highgate has now been equipped with a colour light signalling system in place of semaphore signals. Thirteen are automatic and four semi-automatic.

London.—NEW TUBE STATION COMPLETED.—Down Street station is to close down permanently on May 22nd, the new Hyde Park Corner station being opened for public service on the following day.

TRAFFIC SIGNALS.—According to *The Times*, Councillor W. S. Edgson reported to Westminster City Council last week that the Conference of Metropolitan Boroughs held in the City Hall had unanimously adopted the principle of traffic control by light signals throughout London. The Traffic and Public Lighting Committee had recommended that the cost of provision and maintenance of the signals should be borne in the proportion of 60 per cent. by the Road Fund and 40 per cent. by the Borough Councils. Five new traffic signalling control sites would soon be in operation.

Tasmania.—TRAMWAY ABANDONED.—The Tasmanian Government has decided to close the North-East Dundas tramway line, which connects Zeehan and Williamsford. The line, which is 18 miles long, was built in sections between 1897 and 1910 at a cost of £60,661.

Traffic Signals.—PROPOSED INSTALLATIONS.—It is proposed to install automatic traffic signals at the Nun's Moor Road and Brighton Grove crossing, Newcastle; Lewes and Battle (£340).

Wolverhampton.—TROLLEY-BUS SCHEME ABANDONED.—The Town Council has decided not to proceed with its scheme to provide a trolley-bus service to Cannock and district.

Communications

Great Britain.—COASTAL WIRELESS SERVICE.—Arrangements are being made for the chain of marine wireless stations round the coasts of the British Isles to be fitted with radio-telephone apparatus in order to test the commercial possibilities of such a service for ships in home waters. The new equipment is being supplied to the General Post Office by the Marconi International Marine Communication Co., Ltd., and it will be installed in the existing coastal wireless stations which are now used for telegraph communication with ships. Messages transmitted by telephone from ships to these coast stations will be conveyed by telegram to their destination on land, while telegrams sent to ships equipped for this service will be telephoned from the coast station to the ships.

India.—TELEGRAPHY.—Our Indian Correspondent reports that during the past year the telegraph and telephone mileage of the Indian Post and Telegraphs Department increased by more than 2,000 miles of line and 13,000 miles of wire. At the end of the year there was altogether 105,386 miles of line carrying 490,000 miles of wire, and 1,159 miles of cable containing 82,500 miles of conductors maintained by the Department. At Calcutta, Bombay, Cawnpore, Agra, Akyab, and Vizagapatam, additional Baudot apparatus was installed to improve traffic handling. Steps were also taken to introduce the "teletype" system on busy lines of moderate length. It is in use at present between Delhi and Agra, Calcutta and Patna, and between certain offices in Calcutta.

TELEPHONY.—The number of exchanges owned and maintained by the Government at the end of the year was 296, with 18,800 line connections and 3,100 extension telephones. There were also 390 independent non-exchange systems with 894 telephones. The line mileage increased to 7,200. New exchanges were opened during the year at Arah, Bridaban, Fyzabad, Gurdaspur, and other places, while non-departmental exchanges were also opened at many places. Additional trunk circuits were provided between Rangoon-Insein, Bassein-Henzada, Roorki-Meerut, Muttra-Brindaban, Ambala-Rajpura, and other places. A single-channel carrier system has been established between Benares and Patna in order to provide more satisfactory communication on the Calcutta-Delhi trunk telephone line by removal of the local traffic from the main line. On the main long-distance circuit, with a view to improving efficiency, modern repeater apparatus is to be installed at a number of stations.

RADIO.—The direction-finding stations at Gaya, New Delhi, and Allahabad were completed and those at Tollygunge (Calcutta) and at Bonington (Andamans) were approaching completion. Improved receiving apparatus was also installed at several places. Short-wave communication was established experimentally between Calcutta and Bangkok. Radio-telegrams and foreign radio services continued to give satisfaction. Short-wave communication was also established between Madras and Colombo and gave valuable assistance on occasions when normal service was interrupted. The wireless facilities for air mail routes have also given satisfaction. Modernisation has involved the complete remodelling of eleven stations. Three entirely new stations were completed, of which two are required for civil aviation, and considerable progress has been made in the construction of five more new stations for the same purpose, thus providing for the international air route across India and Burma.

The broadcasting stations at Bombay and Calcutta continued to work directly under the Government of India, and the Calcutta programmes were also broadcast from a small short-wave transmitter at Calcutta. Experimental broadcasting was also permitted at Madras and Lahore.

Philippines.—TELEPHONY.—The Legislature of the Philippine Islands has lately granted authority to the Davao Telephone Co. to install and work a telephone system in the Philippine province of Davao, and any municipality thereof.

Radio Exchanges.—Torquay Town Council has received an application from Rediffusion, Ltd., for permission to establish a wireless relay service, but no action is to be taken.

Great Yarmouth Town Council has deferred applications made by Bowers & Barr, Lincoln & Egerton, and Broadcast Listeners' Services, Ltd.

Barratt Bros., a local firm, has applied to the Whitby Town Council, and Broadcast Listeners' Service, Ltd., to Huntingdon Town Council for permission to start local services.

Rumania.—TELEPHONE IMPROVEMENTS.—The Rumanian Telephone Co., which is associated with the International Telephone & Telegraph Co., plans to install and bring into operation rotary automatic exchanges in more than a dozen of the principal cities in Rumania before the end of 1935. Ploesti is the first city to be completely changed to automatic working and is practically ready to be cut-over, while it is anticipated that by July, 1933, Bucharest will be fully converted to the automatic system.

South Africa.—DURBAN TELEPHONES.—A draft agreement between the Durban Town Council and the Union Government concerning the municipal telephone undertaking provides for immunity from Government expropriation for ten years; an annual payment by the Corporation to the Government of 5 per cent. of the gross revenue from telephones (about £5,000 a year); and the payment of £9,000 by the Government towards the cost incurred by the town in preparing the case against expropriation. When the agreement is concluded the Council will consider changing over the system to automatic working.

Uruguay.—AUTOMATIC TELEPHONY.—Plans have been accepted for the construction at Montevideo of a large underground automatic telephone building for the Usinas Electricas del Estado, which holds the monopoly for the supply of electricity in Uruguay. The contract for the new building has been awarded to a Berlin firm, which is to employ Uruguayan materials wherever possible. The ultimate capacity will be 105,000 lines, and the estimated cost is £345,388 sterling.—*Reuter's Trade Service.*

Contract Information

When "Contracts Open" are advertised in our "Official Notice" pages the date of the "Electrical Review" containing the advertisement is given in parentheses below

Contracts Open

Australia.—MELBOURNE.—May 31st. Posts and Telegraphs Department. Metal jointing sleeves. (G.X. 11463.)*

Carlisle.—May 23rd. Rural District Council. Electrical work at offices. R.D.C. surveyor, 5, Victoria Place.

Cardiff.—May 25th. Electricity Department. E.h.p. and l.p. cables. (May 6th.)

Cheadle and Gatley.—June 7th. Electricity Department. Transformers, switchgear and cable. (See this issue.)

Chefting Wycombe.—May 23rd. Town Council. Electrically driven pumping plant for Pann Mill waterworks. Mr. W. Vaux Graham, 5, Queen Anne's Gate, S.W.1 (deposit £5).

Dumfries.—May 21st. County Council. Twelve kiosks. (May 6th.)

East Ham.—June 14th. Education Committee. Installation of electric lighting at Shaftesbury and Storey Street Schools. (See this issue.)

Eccles.—May 28th. Electricity Committee. Metal-clad transformer and ring-main e.h.p. switchgear control unit.

May 30th. Three 250-kVA, 3-phase, oil-cooled transformers; three 500-kVA sheet-steel transformer kiosks, with e.h.p. and l.p. switchgear equipment; single-phase a.c. house service meters. Borough electrical engineer, Electricity Offices, 1, King Street.

Egypt.—CAIRO.—June 15th. Ministry of Public Works. Electrically driven fuel oil pumping set. (G.X. 11490.)*

Farnworth.—June 3rd. Electricity Department. L.p. cables and disconnecting boxes. (See this issue.)

Galloway.—May 31st. Galloway Water Power Co. Construction of Tongland Dam. Sir Alexander Gibb & Partners, Queen Anne's Lodge, Westminster, S.W.1 (deposit £10 10s.).

Glasgow.—May 23rd. Electricity Department. Cables, flexibles, cookers, kettles and cable covering tiles. (May 6th.)

May 25th. Education Department. Electrical work at Lambhill Street School (deposit £1 1s.). May 26th. Electrical work at Renwick Street School. Education Offices, Bath Street (deposit £1 1s.).

Greece.—ATHENS.—June 1st. Greek State Railways. Diesel or Diesel-electric standard gauge rail coaches. (G. 11410.)*

Irish Free State.—DUBLIN.—Corporation. Public lighting requirements, including time switches, lanterns, &c., for year ending March 31st, 1933. Mr. G. J. Sherlock, city manager and town clerk.

London.—CENTRAL ELECTRICITY BOARD.—June 6th. 33-kV switchgear for the South West England and South Wales Scheme. (May 13th.)

Manchester.—June 6th. Electricity Committee. Automatic telephone equipment at the Dickinson Street Offices and Polygon Depôt. (May 13th.)

New Zealand.—WELLINGTON.—June 22nd. Post and Telegraph Department. Insulators. (A.X. 11335.)*

Portland.—June 1st. Urban District Council. Underground mains, distributors, sub-station equipment and transformers. (See this issue.)

Salford.—May 25th. Education Committee. Electric lighting installations at Pendleton High School for Girls, Eccles Old Road, Pendleton. Director of education, Education Offices, Chapel Street.

Tilbury.—May 30th. Urban District Council. E.h.p. and l.p. cables, switchgear and kiosks. (May 6th.)

Uruguay.—MONTEVIDEO.—July 11th. National Administration of the Port. Electrically operated goods lifts and cranes. (A.X. 11338.)*

Whimple (EXETER).—June 1st. Parochial Church Council. Electric heating installation at Parish Church. Honorary secretary to the Council.

Whitby.—May 25th. Urban District Council. Cables, meters, service boxes, lamps, wiring accessories, &c. (See this issue.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed

Batley.—Electricity Committee. Accepted. Cables.—Derby Cables, Ltd.; Callender's Cable & Construction Co., Ltd. Overhead line.—Craven and District Construction Co. Transformers.—English Electric Co., Ltd.

Bury St. Edmund's.—Town Council. Accepted. 120-kW transformer (£71).—Johnson & Phillips, Ltd. Sixty-two consumers' motors and electrical apparatus in connection with the change-over (£2,110).—Britannia Manufacturing Co., Ltd. Thirty-seven consumers' motors (£961).—Pudney & Co.

Canterbury.—City Council. Accepted. Alteration of generator switches for connection to grid (£1,047).—Ferguson Pailin, Ltd.

Cardiff.—Electricity Committee. Accepted. Transformers: Six 250 kVA (£636).—Metropolitan-Vickers Electrical Co., Ltd. Three 75 kVA (£159).—English Electric Co., Ltd. Two 500 kVA (£362).—Hackbridge Electric Construction Co., Ltd.

Cheltenham.—Electricity Committee. Accepted. Apparatus in connection with change of frequency. Three-phase motors (£216) and single-phase motors (£439).—Brooks Motors, Ltd. Single-phase transformers (£359).—English Electric Co. Three-phase transformers (£360).—Crompton Parkinson Co., Ltd. Scott transformers (£376).—Hackbridge Electric Construction Co. Single-phase public lighting (£1,419).—British Electric Transformer Co., Ltd.

Dalkeith.—Housing Committee. Accepted. Wiring for houses (140).—W. Falconer & Co.

Farnworth.—Urban District Council. Accepted. L.p. cables.—Edison Swan Cables, Ltd.

Glasgow.—Transport Committee. Accepted. Magnetic coils in cases.—Metropolitan-Vickers Electrical Co., Ltd.; Electro-Mechanical Brake Co., Ltd.

Gas Committee. Recommended. Two marble control panels for the Dawsholm gasworks (Temple Station) (£132).—Igranic Electric Co., Ltd.

Health Committee. Accepted. Electrical fittings, &c., for the various hospitals for one year.—William McGeoch & Co., Ltd.

Electricity Committee. Accepted. Plant and appliances required in connection with the change of frequency under the Central Scotland Electricity Scheme; Six transformers (£1,350).—Bruce, Peebles & Co., Ltd. Eight transformers (£1,088).—Brush Electrical Engineering Co., Ltd. Four transformers (£544).—Crompton, Parkinson, Ltd. Four transformers (£338).—Metropolitan-Vickers Electrical Co., Ltd.

Grimsby.—Electricity Committee. Accepted. Galvanised ironwork for western extensions.—Johnson & Phillips, Ltd.

Hastings.—Electricity Committee. Recommended. Electric cookers.—Jackson Electric Stove Co., Ltd.

Public Assistance Committee. Recommended. X-ray apparatus for municipal hospital (£628).—A. E. Dean & Co.

Northern Ireland.—Electricity Board. Accepted. L.p. distribution to Moira, Magheralin, Hillsborough, Waringstown, Richhill, Loughbrickland, Bessbrook, Loughgall, Moy and Charlemont, and Dungannon.—Henley's Telegraph Works Co., Ltd.

Norwich.—Watch Committee. Recommended. Traffic signals (£211).—Laurence, Scott & Electrometers, Ltd.

Salford.—Corporation Tramways Department. Accepted. Traction lamps (twelve months' supply).—Siemens Electric Lamp & Supplies, Ltd.

Southport.—Parks Committee. Accepted. Electric script sign at Floral Hall (£101).—David Rowan Vidro, Ltd.

West Hartlepool.—Corporation. Accepted. Kiosk sub-station.—Crompton Parkinson, Ltd.

Forthcoming Events

Illuminating Engineering Society.—Tuesday, May 24th. Lighting Service Bureau, W.C. 7 p.m. "The Work of a Public Lighting Department." Mr. E. Marrison.

Institution of Electrical Engineers.—May 30th-June 3rd. Harrogate. Summer meeting. (*Western Centre*).—May 20th-23rd. Ledbury Park, near Chepstow. Summer meeting. (*Irish Centre* (Dublin)).—Saturday, May 21st. Trinity College, Dublin. 7.45 p.m. Annual meeting. (*Wireless Section*).—Wednesday, May 25th. Institution, London. 6 p.m. "Our Present Knowledge of the Ionized Regions of the Upper Atmosphere." Prof. E. V. Appleton.

Incorporated Municipal Electrical Association.—June 15th-18th. Cardiff. Annual convention.

Municipal Tramways and Transport Association, Inc.—June 22nd-24th. Grand Hotel, Eastbourne. Annual conference.

Electrical Contractors' Association.—June 28th-30th. Southport. Annual conference.

Overhead Lines Association.—July 1st. Chesham. Summer meeting.

Our Service Department

Inquiries must be accompanied by a stamped addressed envelope.

We shall be glad to learn the names and addresses of the makers of the following:—

Makers of an electrically operated window cleaner.

SILOSIL powder used for lagging electric heating appliances.

SAVETTE saucepans.

A 12,500-kVA Electric Furnace

In a recent issue of the *Revue Industrielle*, M. B. Lacaze describes the 12,500-kVA electric furnace and auxiliary plant which has lately been put in service at the works at Marignac, France, of the Compagnie d'Electricité Industrielle for the manufacture of calcium carbide. The actual furnace is cylindrical in shape and comprises a heavy riveted steel casing lined with refractory bricks and provided with a silicon bed and a hearth of graphite. Power (a.c.) is received at 10,000 V, and is stepped down by three single-phase transformers to a voltage variable between 60 and 175 V. Three groups of copper bars and water-cooled conductors designed for a maximum of 35,000 V supply energy to three Soderberg type electrodes suspended from a system of winches, which enables them to be readily raised and lowered. When working under maximum load, at a power factor of 0.8, the furnace requires about 10,000 kW of power, the specific consumption varying between 3,200 and 3,500 kWh per metric ton of carbide.

Notes

Supply Started in Girvan

The Burgh of Girvan is situated on the Firth of Clyde at the southern extremity of the Ayrshire Electricity Board's area. It is 33 miles from Kilmarnock power station and 21 miles from Ayr, where there is a district engineer and staff. Girvan has no industry except fishing, but is a popular holiday resort, so that the normal population of about 6,000 is trebled during the season.

Supply has been given to Turnberry Hotel, about 6½ miles north of Girvan, for some years. The mains have now been extended to Girvan, and the supply was formally inaugurated on May 13th by Councillor Johnstone, convenor of the Electricity Committee. The six-conductor 11-kV line is controlled at Turnberry by two open-air metal-clad switches placed by terminal "H" poles. At Girvan the lines are brought to a four-panel metal-clad switchboard in an outdoor sub-station which controls two 200-kVA 11/3.3-kV transformers. Two 3.3-kV metal-clad switches control the supply to four kiosks for transforming to low voltage. Single-pole overload circuit-breakers are used for controlling the l.v. distributors.

In view of the exposed position of the installation near the coast-line, "A" poles have generally been used, and the switchgear has been specially designed to withstand gales of over 80 m.p.h., and to be weatherproof under conditions of driving rain or snow. The scheme was carried out to the designs of Mr. W. C. Bexon, M.I.E.E. (engineer and manager, Ayrshire Electricity Board), and under the supervision of Messrs. W. Upton and A. E. Fairlie and his staff, who also erected the sub-station and kiosks. Messrs. Watsham's, Ltd., were contractors for the high-voltage and low-voltage mains, for which the Metropolitan Electric Cable & Construction Co., Ltd., provided 4,000 yds. of 3.3-kV cable and 7,000 yds. of l.v. cable. The metal-clad switchgear and l.v. circuit breakers were supplied by Messrs. J. G. Statter & Co., Ltd. Pictures of the plant appear on page 741.

I.M.E.A. Convention

The official programme of the I.M.E.A. Convention to be held at Cardiff from June 15th to 18th is now available from the secretary, Australia House (Room 503), Strand, London, W.C.2. The main features were given in the ELECTRICAL REVIEW of March 11th (p. 397). The golf competition will be held on the links of the Radyr Golf Club.

The player returning the lowest net score will receive the trophy and replica (presented by Mr. G. F. Dennis, M.I.E.E.). The trophy will be held by the winner for one year. All information may be obtained from Mr. H. W. Angus, Borough electrical engineer, King Street, Eccles, who will be staying at the Queen's Hotel, Cardiff.

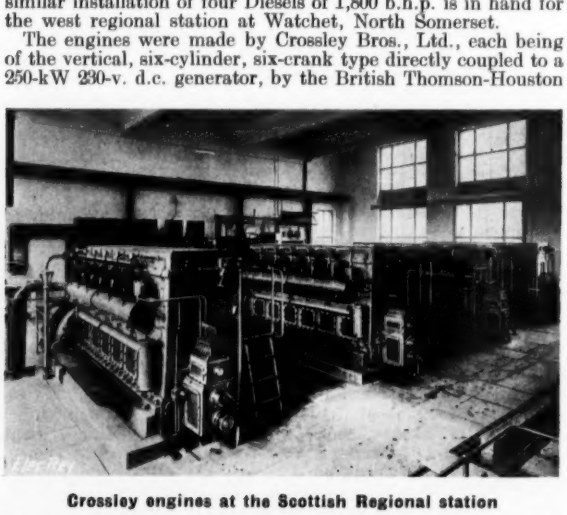
Batti-Wallahs' Luncheon

The next luncheon of the Batti-Wallahs' Society will be held on June 1st at the Hotel Metropole. The chief guest will be Sir John Cadman.

Electricity Generation at the Scottish Regional Station

All the electricity needed by the Scottish regional transmitting station of the British Broadcasting Corporation at Wester Glen, Falkirk, which is shortly to be inaugurated, is to be generated by four Diesel engines totalling 1,560 b.h.p. A similar installation of four Diesels of 1,800 b.h.p. is in hand for the west regional station at Watchet, North Somerset.

The engines were made by Crossley Bros., Ltd., each being of the vertical, six-cylinder, six-crank type directly coupled to a 250-kW 230-v. d.c. generator, by the British Thomson-Houston



Crossley engines at the Scottish Regional station

Co. They are of the compressorless Diesel type, totally enclosed. A very complete system of forced lubrication is incorporated, so that no hand oiling is ever required. All working parts are totally enclosed, but by means of a single movement of the light aluminium top sliding cover plates complete access is given to inlet and exhaust valves, fuel atomisers, and valve operating gear.

The fuel pumps are grouped together in one unit or housing at the governor end of the engine on the floor level. A centrifugal purifier by Hopkinsons, Ltd., is provided for cleaning the lubricating oil. A pyrometer is fitted, also a thermo-couple to each exhaust outlet bend, and thermometers are provided on the return water outlet branch pipes from the cylinder heads, circulation being assisted by a chain-driven water pump attached to each engine. Duplicate electrically driven hot and cold water pumps by the Pulsometer Engineering Co. are provided, and compressed air for starting purposes at 250 lb. pressure per sq. in. is furnished by duplicate sets of Robertson's motor-driven two-stage compressors. The fuel is pumped by Stothert & Pitt pumps, electrically driven, in duplicate. At full and three-quarter load working the makers' guaranteed fuel consumptions on Diesel oil is equivalent to 0.58 lb. per kWh generated and at half load 0.65. The net lubricating oil consumption guaranteed is one pint per engine hour.

Radio Air Traffic Control

What is believed to be the first demonstration of air traffic control by wireless telephony was staged by Standard Telephones & Cables, Ltd., at the Household Brigade Flying Club meeting at Heston on May 18th. The traffic controller was Captain Duncan Sinclair, now head of the Aviation Division of Standard Telephones & Cables, and formerly in charge of civil aviation signals at the Air Ministry. Five or six machines, all fitted with the new "Standard" light aircraft receiver for private aeroplanes, took part. With this equipment, which uses a fixed instead of a trailing aerial, spoken messages can be received, not only during flight, but also when the machine is on the ground, taxi-ing, taking off, or landing. The machines are therefore under the telephone instructions of the controller from the moment they leave the hangars until the time they are put back. They take off in the order indicated by him, and after flying a short distance return to the air port, appearing simultaneously from different directions. The controller then instructs them as to the order in which they are to land, and when they have all landed he orders them back to the hangars.

The Czechoslovak Electrical Association

The 14th national convention of the Czechoslovak Electricity Association will be held at Bratislava from June 3rd to 7th. Names and addresses of delegates and guests should be sent to the Association at Prague, Czechoslovakia, before June 1st. The programme includes the exhibition of new types of electrical apparatus, 26 lectures on technical subjects, the submission of additions to the national electricity safety code, and visits to places of technical interest.

Educational

I.E.E. SCHOLARSHIPS.—The Institution of Electrical Engineers is to make the first award of the Swan Memorial Scholarship (of the value of £140, tenable for one year) this year. Preference will be given to candidates who were born or resident in the County Borough of Sunderland, or educated at the Sunderland Technical College. Like the Ferranti Scholarship (of the annual value of £250, tenable for two years, which is also to be awarded this year) nomination must be made not later than August 15th, 1932, by the professor or teacher under whom the candidate has worked for whole-time research or post-graduate work.

The Duddell Scholarship (of the annual value of £150, tenable for three years) and the Silvanus Thompson Scholarship (of the value of £100 per annum and tuition fees, tenable for two years, for works' employés) are also to be awarded this year. Nominations must be made not later than June 15th, 1932, by corporate members of the I.E.E. for whole-time courses.

MANCHESTER.—The Municipal College of Technology has issued a prospectus of short summer courses of lectures and laboratory work, which are to commence on May 30th, and continue till July 23rd.

(See our advertisement pages to-day.)

A course of four lectures on "Electrical Heating of Water" will be given by Mr. D. J. Bolton at the Regent Street Polytechnic, W.1, commencing June 2nd.

A Jury's Advice

The safety device on an electric kettle was the cause of the death of Catherine Murphy, aged 15, of 158, Buchanan Street, Coatbridge, on April 9th. Apparently the kettle had fused and the operation of the safety device had prevented the plug from being inserted in the kettle, and the girl, in trying to force the plug in, had come into contact with the two prongs. A verdict of "Accidental death" was recorded at the inquiry held in the Justiciary Court, Glasgow, on May 12th, before Sheriff Wilton. The jury added a rider to the effect that the suppliers of domestic electrical appliances should issue clear directions to all consumers warning them against interfering with safety devices and advising them to call in skilled assistance in the event of trouble.

Appointments Vacant

Foreman for electrical maintenance for the South Indian Railway Co., Ltd.

Assistant in Mains Department for Islington Borough Council.

(See our advertisement pages to-day.)

I.E.E. Golf Competition

The annual golf competition organised by the Mersey and North Wales (Liverpool) Centre of the Institution of Electrical Engineers with the object of raising funds for the Benevolent Fund is to be held on May 25th on the course of the West Lancashire Golf Club.

Our Personal Column

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements

Institution Awards.—The Council of the Institution of Electrical Engineers has made the following award of premiums for papers read during the 1931-32 season, or accepted for publication :—

Institution Premium, Mr. J. Bruce; Ayrton Premium, Mr. F. Lydall; Fahie Premium, Messrs. H. Kingsbury and R. A. Goodman; John Hopkinson Premium, Mr. H. W. Clothier; Kelvin Premium, Prof. W. M. Thornton and Dr. W. G. Thompson; Paris Premium, Messrs. E. W. Dickinson and H. W. Grimmitt; and Extra Premiums, Messrs. H. Blades and A. C. MacQueen, Messrs. R. O. Kapp and C. G. Carrothers, Dr. F. Luschen, Messrs. H. Pearce and T. T. Evans, Mr. E. A. Watson, Major E. H. E. Woodward, and Mr. W. A. Carne.

Wireless Section: Duddell Premium, Mr. T. L. Eckersley; Extra Premiums, Messrs. B. S. Gossling, J. A. Ratcliffe, L. G. Vedy, and A. F. Wilkins.

Meter and Instrument Section: Silvanus Thompson Premium, Prof. J. T. MacGregor-Morris and Mr. H. Wright; Extra Premium, Mr. S. H. C. Morton.

Ald. T. E. Higham (Accrington) has been re-elected chairman, and **Ald. H. P. Nuttall** (Burnley) vice-chairman of the Mid-Lancashire Electricity Advisory Board.

Mr. Harry Moss was elected as chairman of the Bradford branch of the Electrical Contractors' Association, at the annual meeting on May 11th, and Mr. A. Smith was re-elected secretary and treasurer.

Mr. W. Creswell and **Miss E. M. Belch,** members of the staff of Crompton Parkinson, Ltd., Chelmsford, have been presented by their colleagues with a silver tea service on their marriage.

Mr. L. A. Waller, chairman and joint manager of Switchgear and Cowans, Ltd., who has been suffering from ill-health for many months, has returned from the Mediterranean fully restored to health.

Mr. A. McLellan, technical adviser to the Overseas Communications Co., of South Africa, Ltd., is now on his way to this country *via* the East Coast route. He will stay in England for about six months.

Dr. Edward Mallett, Assistant Professor of Electrical Engineering at the City and Guilds (Engineering) College, has been appointed Principal of Woolwich Polytechnic. He will succeed **Mr. A. F. Hogg,** who is retiring after 20 years' service.

Mr. Sidney Burns, deputy engineer in the Newcastle-upon-Tyne Electric Supply Co.'s Change-of-Frequency Department, has been elected president of the North of England branch of the Association of Mining Electrical Engineers.

Mr. H. F. Yelland, whose article on "E.H.P. Switchgear" appears on page 731, commenced his apprenticeship at the Willesden works of the British Thomson-Houston Co., Ltd., in 1918. While there he gained valuable experience during the busy years of post-war reconstruction, particularly in connection with switchgear. He left the British Thomson-Houston Co. to join Messrs. Crompton & Co., at Chelmsford, and subsequently he secured an appointment with Messrs. Johnson & Phillips, Ltd., as a switchgear engineer. Mr. Yelland contributed an article on "Kiosk Substations" to our pages two or three years ago.

Mr. H. F. Yelland, author of the article on "E.H.P. Switchgear" on p. 731

Mr. A. Gray.—To mark the retirement, which took place at the end of last year, of Mr. Andrew Gray, formerly technical general manager of Marconi's Wireless Telegraph Co., Ltd., the Marchese Marconi presented him on May 11th with a group of three water colour pictures, on behalf of the staffs of the company and its associated organisations. The Marchese Marconi referred appreciatively to the services rendered by Mr. Gray in the development of wireless communications since he joined the Marconi Company in 1899, and expressed his satisfaction that Mr. Gray would continue to be connected with the company in a consulting capacity. He pointed out that the pictures were the work of Mr. Gray's late sister, Miss Nora Neilson-Gray, from whose posthumous exhibition they had been specially selected. With the pictures was a book containing the signatures of nearly 500 members of the Marconi organisation. Those attending the presentation, which took place at Marconi House, included the Marchesa Marconi, Mr. Alfonso Marconi, Mr. H. A. White, general manager of the company, Mr. C. E. Rickard, deputy general manager, Mr. F. S. Hayburn, deputy managing director of the Marconi International Marine Communication Co., Ltd., and Mrs. Hayburn, and the chiefs of departments and many members of the staff. Telegrams of greeting were received from the Rt. Hon. F. G. Kellaway, P.C., and Mr. J. C. Denison-Pender. Mr. Gray's portrait was reproduced in our issue of December 18th last (p. 935).

Mr. G. P. Govie was elected president of the Midland branch of the Association of Mining Electrical Engineers at the monthly meeting held recently at the Technical Institute, Mansfield.

Mr. F. A. Orchard, M.I.E.E., has resigned from the staff of Mr. D. Maxwell Buist, manager of the North-East England Area of the Central Electricity Board, to take up the position of chief assistant to Mr. N. S. Tennant, general manager and engineer of the Newcastle and District Electric Lighting Co., Ltd. For the past two years Mr. Orchard has handled the change of frequency operations on behalf of the Board. Prior to joining the C.E.B. staff he was for twelve years with Messrs. Merz & McLellan, Newcastle, by whom he was engaged chiefly in the supervision of large contracts for the electrical equipment of super-power stations and sub-stations both at home and abroad, and latterly was for two years in charge of the electrical inspection organisation. During his service with Messrs. Merz & McLellan he visited India, Switzerland, and Sweden on behalf of the firm. Prior to this he had had extensive design and commercial experience with the British Westinghouse Co., Dick, Kerr & Co., the British Thomson-Houston Co., Ltd., and Siemens Bros. Dynamo Works. Mr. Orchard takes up his new duties on June 1st.

[Elliott and Fry.
Mr. F. A. Orchard

Obituary

Col. B. C. Battye.—A *Reuter* despatch received in London from Lahore early in the week reported that Lieut.-Col. Basil Condon Battye, D.S.O., late R.E., chief engineer of the hydro-electric branch of the Punjab Government had been killed in a motor accident near Batala, in the district of Gurdaspur. Col. Battye was on his way to inspect the hydro-electric works of Jogendranagar. The report stated that Major R. N. Aylward, another official of the same department, had been seriously injured. Col. Battye, who was born in 1882, saw service in the Somaliland campaign, 1903-4, and he was connected with the Simla hydro-electric scheme from 1910-1914. He was on active service in France during the war, from 1914-1918, was wounded, and was seven times mentioned in dispatches. He was awarded the D.S.O. in 1916. Subsequently he was appointed engineer in charge of the design and construction of the Punjab hydro-electric scheme in connection with which he was journeying when the accident which has ended fatally occurred. He was an A.M.Inst.C.E., A.M.I.E.E., and a member of the American Civil and Electrical Engineering societies. Col. Battye leaves a widow, three sons and two daughters.

Mr. J. F. C. Bigland.—We regret to learn of the death, which occurred last week, of Mr. J. F. C. Bigland, maintenance engineer at the Spondon power station of the Derbyshire and Notts Electric Power Co. He was 43 years of age. Mr. Bigland entered the service of the company in 1920 (he was previously at Lancaster), and was in charge of the Ilkeston power station until the transfer to Spondon in 1923. At the funeral held on May 10th members of the staff acted as bearers. The employés walked to the cemetery in procession from the company's offices at Ilkeston. Mr. A. D. Phillips, manager and director of the company, was present.

Mr. R. G. Ross.—Mr. R. G. Ross, who was known to the trade for a number of years as representative of Messrs. Dexine, Ltd., passed away suddenly on May 9th. Mr. H. Butcher has been appointed to succeed him.

Wills.—Mr. Walter Clark, of Lewisham, electrical engineer, left £13,451 (net personalty £13,418).

Col. John Lynn Marr, of Sunderland, a director of the Electrical and General Stores, Leeds, and other engineering concerns in the district, left £30,309 (net personalty £18,625).

Financial Section

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares

New Companies Registered

J. L. Schofield, Ltd.—Private company. Registered May 12th. Capital £1,000 in £1 shares. Objects: To acquire the business of an electrical engineer and dealer in wireless apparatus heretofore carried on by J. L. Schofield at 28, St. Albans Road, St. Anne's-on-Sea. The subscribers are J. L. Schofield and Mrs. D. Schofield, both of 28, St. Albans Road, Lytham St. Anne's.

Davis Brothers Illuminating Engineers, Ltd.—Private company. Registered May 9th. Capital £3,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in electrical goods or apparatus, wireless and gramophone dealers, &c. The directors are: T. Davis, 42, Loraine Road, N.7; and F. R. Davis, 40, Richmond Road, N.1.

Adkins & Philpott, Ltd.—Private company. Registered May 7th. Capital £3,000 in £1 shares. Objects: To carry on the business of electrical engineers and general electrical installation contractors, &c. The directors are: F. S. Adkins, The Limes, Farthinghoe, near Brackley, Northants; and S. F. Philpott, 3, Pleydell Road, Swindon, Wilts. Secretary: F. S. Adkins. Solicitors: G. B. Pickering, 16, Unicorn Hill, Redditch.

Ilford Electrical Co., Ltd.—Private company. Registered May 12th. Capital £100 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in electrical and wireless apparatus and equipment of all kinds, etc. The subscribers are: J. Ismay, 108, Westbourne Terrace, W.2 and J. S. Walford, 6, Clarence Avenue, Ilford. J. Ismay signs documents as director.

Ibros Radio, Ltd.—Private company. Registered in Edinburgh on May 7th. Capital £500 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in all kinds of wireless and television instruments, &c. The directors are: N. Hill, 200, Paisley Road, West, Glasgow, and Mrs. Leah Hill, 183, Queen's Drive, Glasgow. Registered office: 200, Paisley Road, West, Glasgow.

Glick's Radio, Ltd.—Private company. Registered May 7th. Capital £1,000 in £1 shares. Objects: To carry on the business of dealers in wireless accessories and goods, electrical goods, &c. The subscribers are: H. Glick, 14, Tudor Road, Cardiff; and R. D. James, Dolau Gwyn, Tonyrefail. Secretary: M. Roberts. Registered office: 14, Tudor Road, Cardiff.

Johnsons Radio & Television, Ltd.—Private company. Registered May 2nd. Capital, £2,000 in £1 shares. Objects: To acquire the business of an electrician and radio dealer carried on by H. R. Johnson at Ladypool Road, Birmingham. The permanent directors are: H. R. Johnson, 311, Haunch Lane, King's Heath, Birmingham, and Mrs. A. Johnson, 358, Ladypool Road, Birmingham. Secretary: H. R. Johnson. Registered office: 352a, Ladypool Road, Birmingham.

"Ohm Sweet Ohm" Electrical Appliances, Ltd.—Private company. Registered April 22nd. Capital, £100 in 10s. shares (100 preference and 100 ordinary). Objects: To carry on the business of electrical, mechanical, general and consulting engineers, light, heat and power producers and suppliers, manufacturers of and dealers in electrical appliances, &c. The directors are: W. Hodges, 39, William Street, Sheffield, and O. B. Wells, "Eastbourne," Totley Brook Road, near Sheffield.

Associated Radio Productions, Ltd.—Private company. Registered May 5th. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in gramophone and sound producing machines, radio apparatus and batteries, &c. The permanent directors are: J. S. Clark, 25, Shirley Avenue, Shirley Park, Croydon, Surrey, and A. W. Moir, Gosforth House, 74, College Road, Dulwich. Solicitor: W. H. Sanders, 7, Bloomsbury Square, W.C.1.

Returns of Electrical Companies

India Rubber, Gutta Percha, and Telegraph Works Co., Ltd.—Capital, £1,250,000 in 750,000 ordinary, 250,000 preference, and 250,000 unissued shares of £1 each. Return dated December 29th, 1931. 750,000 ordinary and 250,000 preference shares taken up. £1,000,000 paid. Mortgages and charges, £400,000.

Julius Sax & Co., Ltd.—Capital, £10,000 in 3,000 7½ per cent. preference shares of £1 and 35,000 ordinary shares of 4s. each. Return dated December 22nd, 1931. 2,650 preference and 18,000 ordinary shares taken up. £5,051 paid on 2,650 preference and 12,005 ordinary shares. £1,199 considered as paid on 5,995 ordinary shares. Mortgages and charges, nil.

Keighley Electrical Engineering Co., Ltd.—Capital, £10,000 in 3,000 preference and 7,000 ordinary shares of £1 each. Return dated January 11th, 1932. 2,300 preference and 4,200 ordinary shares taken up. £4,488 paid. £2,012 considered as paid. Mortgages and charges, £3,681 18s. 8d.

Burma Electric Supply Co., Ltd.—Capital, £270,000 in 120,000 ordinary and 150,000 preference shares of £1. Return dated December 23, 1931. 120,000 preference and 120,000 ordinary shares taken up. £100,000 paid on 100,000 preference shares. £140,000 considered as paid on 120,000 ordinary and 20,000 preference shares. Mortgages and charges, nil.

R. Falshaw, Ltd.—Capital, £5,000 in £1 shares. Return dated December 30th, 1931. All shares taken up. £2 paid. £4,998 considered as paid. Mortgages and charges, nil.

William J. Hook & Co., Ltd.—Capital, £1,000 in 500 preference and 500 ordinary shares of £1 each. Return dated December 28th, 1931. 400 preference and 3 ordinary shares taken up. £403 paid. Mortgages and charges, nil.

Oldhill Manufacturing Co., Ltd.—A. M. Fleming, 16 and 17, Devonshire Square, E.C.2, ceased to act as receiver on April 30th.

Northampton Electric Light & Power Co., Ltd.—Particulars filed of £100,000 debentures, in addition to £400,000 already registered, authorised by resolutions of March 11th, 1924, October 21st, 1926, November 12th, 1929, and March 15th, 1932, and covered by trust deed dated April 25th, 1932 (supplemental to trust deeds dated June 2nd, 1924, November 9th, 1926, and December 10th, 1929), the amount of the present issue being £63,000. Property charged: The company's undertaking and property, present and future, including uncalled capital. Trustees: C. A. Markham, Northampton; and others.

Maybrook Electrical Co., Ltd.—G. E. Sendell, 36, Walbrook, E.C.4, was appointed receiver on April 27th under powers contained in prior lien debenture dated August 25th, 1928, and first and second debentures created in 1924.

Wye Lighting, Heating and Power Co., Ltd.—Satisfaction in full on February 24th, 1928, of mortgage in favour of Lloyds Bank Ltd., dated January 3rd, 1927, and registered January 8th, 1927. (Notice filed May 6th, 1932.)

F. O. Coward, Ltd.—Capital £1,500 in £1 shares. Return dated January 14th, 1932. 1,245 shares taken up. £120 paid. £1,125 considered as paid. Mortgages and charges, nil.

Globe Electrical Co., Ltd.—Capital £3,500 in £1 shares. Returns of allotments, made up to January 22nd, 1932, show 2,635 shares allotted, payable in cash and fully called up. No mortgages and charges registered.

Selfix Electric Co., Ltd.—Capital £1,000 in £1 shares. Return dated January 11th, 1932. 691 shares taken up. £335 paid. £356 considered as paid. Mortgages and charges, nil.

Electroflo Meters Co., Ltd.—Capital £21,000 in £10 shares. Return dated April 13th, 1932. 2,090 shares taken up. £10,900 paid. £10,000 considered as paid. Mortgages and charges, nil.

Charles R. Dibben, Ltd.—Debenture dated April 22nd to secure £700, charged on the company's property, present and future, including uncalled capital. Holder: Mrs. S. E. Brown, 40, Woodville Road, Bexhill-on-Sea.

Clark & Moir, Ltd.—P. W. Moll, 23, Coleman Street, E.C., was appointed receiver and manager on April 27th, under powers contained in debentures dated November 20th, 1929.

City Notes

The London Electric Wire Co. & Smiths, Ltd., held its annual meeting on May 12th, Mr. W. J. Terry (chairman), presiding. In presenting the report and accounts (ELEC. REV., May 13th, p. 721), the chairman said that owing to the general trade depression and the continued fall in the prices of raw materials stocks had been reduced, while at the same time economic working and efficient service had been maintained. Subsidiary companies had been working at a profit, and dividends received had been included in the accounts. The fluctuations in the price of copper were again of an abnormal character throughout 1931, and there was some difficulty in covering contracts made at prevailing market prices. The existing price of copper was below its economic value, but if a free market for the metal existed, together with the present restriction of output, a better state of affairs would be speedily brought about. The company had maintained its position, although the prevailing world depression had limited business to considerably less than manufacturing capacity. Changes in organisation to effect economies had been and were still being made. A considerable advance had been made in the quality of their enamelled wires, and although prices were very competitive, it was hoped that business would greatly increase. On the radio side of the business it was also expected that there would be further development in the near future. The directors had been, and were, giving careful consideration to a widening of the scope of the company's activities both as regards the products of manufacture and methods of distribution. Referring to the Abnormal Importations Act, the chairman said that a scientifically imposed tariff would be of great benefit to their industry, but its imposition must be for definite extended periods, otherwise there would be further serious dislocation in trading conditions. There was still a large field for the expansion in the home markets of the electrical industry which at the moment was severely handicapped by the reduced spending power of the community, due to excessive taxation which was neutralising the benefit that might otherwise accrue from the newly imposed import duties.

The Delhi Electric Supply & Traction Co., Ltd., reports that the net revenue for 1931, including interest on deposits, &c., was £48,346, to which is added £21,860 brought forward, making £70,206. After providing £8,462 for depreciation and renewals, £8,000 for British and Indian taxation, £9,299 for general reserve, and £393 for staff benefit, it is proposed to pay a final dividend of 8 per cent., making 12 per cent. for the year, and to carry forward £21,052. The electrical energy sold increased from 5,944,747 to 6,252,197 kWh, and the number of passengers carried by the transport undertaking from 6,846,380 to 6,999,278.

The annual meeting was held on May 12th, when Mr. K. A. Scott-Moncrieff (chairman) said that the bad trade and unstable conditions prevailing in 1930 continued during 1931, but more recently, owing to the changed attitude of the authorities, steps had been taken to prevent the organised obstruction of the tramway routes, and the returns of the tramway system had accordingly improved. The number of consumers at the end of the year was 11,928, and the total connections 14,886 kW, and had normal business activities prevailed sales of electricity would have been considerably greater, as many shopkeepers closed their premises at dusk when there was a likelihood of disturbance. Failing agreement as to bulk supply from the New Delhi station, they would

soon have to increase their generating plant still further. Terms had been arranged with the Delhi Municipality for a new street lighting contract which would run until March 31st, 1936.

The Cawnpore Electric Supply Corporation, Ltd.—Presiding at the annual meeting on May 11th, Mr. J. G. B. Stone (chairman) said that the satisfactory result of the year's operations had been obtained in spite of the dislocation of business occasioned by riots which took place in March of last year, and which resulted in the closing down of the works of all their bulk supply consumers for one week and the restriction of their activities for a much longer period. The sales of electricity totalled 38,332,048 kWh, an increase of 6 per cent. on the preceding year, while the maximum demand was 9,349 kW, an increase of 10 per cent. over 1930. During the year 158 additional lamps were added to the public lighting installation and improvement of street lighting was at present under discussion. Hitherto bulk supplies had been charged for on a two-part tariff, based upon the size of the installation and the electrical energy consumed, but towards the middle of last year a flat rate was introduced and as a result they secured further important contracts. These flat rate bulk supplies effected a reduction in their charges, but with the economies to be derived from their new plant and the increased output they expected to maintain the present margin of profit. A two-part tariff for ordinary consumers had been introduced.

The Chloride Electrical Storage Co., Ltd., reports a decrease in net profit from £259,876 in 1930-31 to £214,834 for the year ended March 31st last. The addition of £80,505 brought forward and £20,000 written back from battery maintenance reserve makes a sum of £315,339 available. The sum of £55,965 has been written off in respect of accumulated losses incurred by subsidiary companies in Great Britain, and the directors recommend a final ordinary dividend of 5 per cent., tax free, making 10 per cent., free of tax, for the year (against 15 per cent. for 1930-31). £40,000 is reserved for income tax and £11,500 is placed to employés' funds, leaving £101,213 to be carried forward. Last year the general reserve received £97,438. Investments in subsidiary concerns rose during the year from £1,230,214 to £1,247,350, and in connection with this expansion the directors issued 25,000 "B" ordinary shares at 50s. per share; the premium on these has been used to write down investments in subsidiaries. A combined statement of the financial position of subsidiary companies shows that these investments stand in the parent company's books at £83,654 less than the value of the subsidiaries' surplus assets. Meeting: May 27th.

The International Telephone & Telegraph Co.'s report for 1931 shows that a substantial profit was received from the company's foreign manufacturing subsidiaries, although the amount was considerably below that of the two preceding years. Although telephone activities expanded, there was a substantial decline (about 20 per cent.) in cable receipts. Reference is made in the report to the proposed agreement for the interchange of Ericsson Telephone Co. shares. It is said that the agreement was rescinded early this year and that a parcel of 610,000 Ericsson shares which had been deposited by Kreuger and Toll with a Swedish bank against $11,000,000 cash from the International Co. were being held by the bank as collateral against the repayment of the amount mentioned.

The Shanghai Electric Construction Co., Ltd., reports a profit of £167,492 for 1931, as compared with £142,964 in the preceding year, to which is added £16,996 brought in making £184,488. From this provision is made for renewals (£40,000) and taxation (£30,000), and £1,972 is contributed to the Shanghai staff provident fund. It is proposed to pay a final dividend of 7½ per cent., tax free, making 12½ per cent. for the year (12 per cent. in 1930), and to carry forward £37,516. As managers of the Singapore Traction Co., Ltd., the company participated in the profits of that company, for the year ended September 30th last, to the extent of £14,000. Meeting: May 25th.

Edmundson's Electricity Corporation proposes to increase its capital to £6,000,000 by the issue of 2,000,000 6 per cent. cumulative preference shares of £1 each, and 850,000 additional ordinary shares of £1 each. In addition, it is understood that £1,000,000 of new 5 per cent. debentures will be placed privately. The additional capital is required for the purpose of acquiring shares in the Reading Electric Supply Co., Ltd., the Bedfordshire, Cambridgeshire and Huntingdonshire Electricity Co., Ltd., the Shropshire, Worcestershire and Staffordshire Electric Power Co., Ltd., the Urban Electric Supply Co., Ltd., and the Thames Valley Electric Supply Co., Ltd. It is also proposed to convert the existing 7 per cent. preference shares into 6 per cent. cumulative preference shares. A meeting to approve these proposals is to be held next Tuesday (May 24th), at 11, Tothill Street, S.W.1.

The Anchor Cable Co., Ltd., reports a profit of £52,604 for 1931, as compared with £65,015 in the preceding year, from which is deducted depreciation, debenture interest, &c., leaving a balance of £45,896. It is proposed to pay a final dividend of 15 per cent., making 20 per cent., less tax, for the year, leaving £6,896, which, with £178,602 brought in, makes £185,496 to be carried forward. The report states that the past year has been one of great difficulty, and the company has had to meet a larger amount of expenditure than in the previous year; nevertheless, the directors consider the results satisfactory.

Philips' Glowlamp Works reports a profit of £626,000 at par for the past year, as against £1,650,000 in 1930. A sum of £190,000 was allocated to sterling losses, and £83,000 was placed to reserve against bad debts, the net profit amounting to £337,000 (£453,000). A dividend of 4 per cent. is proposed on the ordinary shares (against 6 per cent). A suggestion is to be considered at the annual general meeting that a neutral committee of three leading accountants should be appointed to exercise strict control over the concern.

The Chiswick Electricity Supply Corporation, Ltd., proposes to increase its capital to £250,000 by the creation of 50,000 shares of £1 each. The new shares will be offered to present shareholders in the proportion of one share for every four held at 21s. per share. They will not participate in any interim dividend payable in July next, but will otherwise rank *pari passu* with the existing shares.

The Associated Gas & Electric Co. reports a net revenue of $43,046,181 for 1931, as compared with $42,617,364 for the preceding year. After providing for operating expenditure, dividends on preferred and preference capital, &c., there was a credit balance of $3,812,939. Successful efforts have been made to improve the company's position by the reduction of short-term debts.

Richard Johnson & Nephew, Ltd., report a net profit of £34,991 for the year ended March 31st last, as compared with £31,914 for 1930-31. The ordinary dividend is raised from 5 to 7 per cent., and £24,318 (against £20,384) is carried forward. An increased volume of business was transacted, although selling prices were reduced. Meeting: May 27th.

The Madras Electric Supply Corporation reports a net profit for 1931 of £66,657, as against £69,011 in the preceding year. The final ordinary dividend is 5½ per cent., making 8 per cent. for the year, tax free (same), general reserve again receives £10,000 and £11,452 (£10,625), is carried forward. The sales of electricity totalled 23,984,372 kWh, an increase of 16.53 per cent.

Whitehall Electric Investments, Ltd., reports a net income of £378,082, for the year ended March 31st last, as compared with £443,142 in the preceding year. To this is added £118,426 brought in, making £496,509. The preference dividend requires £187,500, and it is proposed to pay an ordinary dividend of 3 per cent. (against 5 per cent.), and to carry forward £159,009. Meeting: May 24th.

Siemens Bros. & Co., Ltd., recommend a final dividend of 5 per cent., less tax, on the ordinary shares, making 7½ per cent. for the year (same).

The British Power & Light Corporation (1929), Ltd.—It is reported in connection with the issue of 600,000 £1 6 per cent. cumulative preference shares advertised on May 10th, that the list was closed on the following morning, the issue having been fully subscribed.

Callender's Cable & Construction Co., Ltd., has altered the date of its annual general meeting to May 31st, instead of June 2nd, as previously announced.

Laurence, Scott & Electromotors, Ltd., reports, according to a financial paper, a trading loss of £31,796 for the past year as compared with a profit of £949 for 1930. After providing for depreciation, &c., there was a debit balance of £35,778 which has been met from general reserve.

Stocks and Shares

TUESDAY EVENING.

REDUCTION in the Bank Rate to 2½ per cent., announced on Thursday in last week, served to whet anticipations of the fraction coming off in the near future. A 2 per cent. Bank Rate would be regarded as sufficient notification of the conviction that money is likely to be cheap for a long time to come. The inevitable corollary to money being a "drug in the market" is a general slackness of trade and industry. So, at all events, all past experience has shown. Present conditions may lead, however, to a lightening of the load of taxation by enabling the Government to reduce the rate of interest paid upon the 5 per cent. War Loan. The credit of the country has been raised to a level of 4 per cent. or less, and "money" stocks, of every kind, are steadily appreciating in value.

Electricity Stocks

It is natural, in such circumstances, that investment attention should be closely directed to such securities as those of the Central Board and the London and Home Counties J.E.A. That there will be further issues of stock from both these authorities is considered fairly certain, but new offerings of their stock will be made upon terms very much more advantageous to the borrowers than the latter were able to command in the past. This is clear, of course, from the fact of the last-issued Central Electricity stock standing at 9¼ premium, and the London and Home Counties new scrip being up to 3⅜ premium. Earlier this year, the former stock could have been bought, in substantial amounts, at 2 discount. To-day, there is none too liberal an amount to be obtained at 11½ points higher.

Metropolitan and District Debentures

Attention was drawn here some weeks ago to the fact that District 5 per cent. debenture was standing about 3¼ points above the Metropolitan Railway 5 per cent. debenture, which came out shortly after the District offer. Austerely, the District debenture is the stronger security of the two stocks, because of the partial Government guarantee attached to it. The Metropolitan debenture stands upon its own feet. But if the Metropolitan Railway should be taken into the London Traffic Pool, the security of the two debenture stocks might become identical. Indication of this possibility has led to buying of the Metropolitan stock, with the result that the price has advanced to 7¼ premium, the District debenture being now the same price. In each case the stock came out at 97½.

Home Railway Stocks

After its breathless rise of eleven points in less than a month, Metropolitan consolidated stock slipped back to 43½, but the reaction was recovered after the holiday. There is vague talk, attracting more interest than purchases of stock, as to a comprehensive development scheme at Pinner, by the Metropolitan Railway. The price of Districts is unchanged at 51½, and "Undies," to give the shares their Stock Exchange nickname, remain at 17s. The three assented stocks of the Central London Railway are quoted at 72½, at which the yield is 5½ per

cent. on the money, a rate attractive enough to deserve attention from the investor. The three unassented stocks of the Central London, together with the ordinary stocks of the City and South London and the London Electric Railways, stand between 50 and 55, the market in all of them being extremely restricted. Business in Central London deferred was last recorded in May, 1930, at 77½, some 25 points above to-day's nominal figure.

In the Home traction list, British Electric deferred is 25 points down, for the third successive week, the price being now 650.

The Strength of Electricity Supply Shares

In spite of the fact that the official quotations show few changes, the market in London lighting shares is decidedly good. There are more buyers than sellers. Reference to the last column in our list of prices will show that the yield to be obtained from the London companies' ordinary shares averages about 5 per cent. Nor is there any large amount of supply available. Amongst shares on offer, at the time of writing, may be mentioned a thousand each of County ordinary at 43s. 3d., returning £4 17s. per cent., City of London at 38s. (cum bonus) giving £4 18s. 3d., and Metropolitan at 42s. 3d., upon which the yield is 4½ guineas per cent. The new County of London, issued at 38s. 6d., have risen 1s. to 3s. premium.

Provincial supply companies shares are equally strong in tone. Midland Counties have hardened to 28s. 9d., and Newcastle-on-Tyne to 23s. 9d. The newly offered Scottish Power, of which the allotments to non-shareholders were extremely small, are an active market in the London and the Scottish Stock Exchanges, at a shade under 1s. premium. The issue price was 23s.

Edmundson's Electricity Corporation proposes to increase its capital to six million pounds sterling, in order to acquire ordinary shares in five different electric supply undertakings and to take over a debt owing by one of them to the Greater London and Counties Trust. The meeting is to be held on May 24th to approve the increase. Of the Edmundson's ordinary capital, all but 1 per cent. is held by the Greater London and Counties Trust. The 7 per cent. preference shares are quoted at 26s.

Telegraphs and Telephones

The better tendency for Cables and Wireless stocks which made itself felt last week continues. Amongst other cable issues the changes are insignificant. Great Northern Telegraphs have improved ½ to 23. American Telephone and Telegraphs remain at 135, but International Telephones have gone back to 7. Orientals are maintained at 2⅜, upon the continuance of the 12 per cent. dividend including bonus for the past year.

Business has been done this month at 58 in Constantinople Telephone 6 per cent. obligation bonds, and in British Columbia Telephone 6 per cent. preference at 110¼. Telephone Rentals are 4s. 3d., Telephone Manufacturing 2s. 6d. The 4 per cent. debenture stocks of the Western, Eastern and Eastern Extension companies have been advanced to 78½ for the Western, and 80½ for the two other issues. Bengal Telephone 7 per cent. first mortgage bonds and Jutland Telephone 5½ per cents. improved to the common level of 101.

The Foreign Group

Mexican Light and Power shares have fallen still further, the 5 per cent. first mortgage gold bonds being 5 points down at 57½. The 7 per cent. preferred shares at 22½ show a fall of 3, although the last-recorded business in the shares, marked a couple of months ago, was at 39 and 38. Mexican Electric Light 5 per cent. first mortgage bonds have fallen to 50½, and Mexico Tramway 5 per cent. bonds at 27½ are down 5. In the Argentine list, Anglo-Argentine 5 per cent. debenture stock at 8 shows a fall of a point. Stock has changed hands during the past few days as low as 6½. Brazilian Tractions remain about 12. Rio Tramway bonds and San Paulo Tramway bonds have both gone back a couple of points. In the Latin-Canadian group, Shawinigans are lower at 14. Tokyo Electric 6 per cent. bonds came on offer at 60, in sympathy with weakness in Japanese bonds, following the assassination of the country's Premier.

Whitehall Electric 7½ per cent. preference, after their abrupt drop, rallied 1s. 9d. to 16s. 3d. upon declaration of a 3 per cent. dividend on the ordinary shares. This goes against 5 per cent. for 1930, but is better than some people had anticipated.

Manufacturing and Equipment

Following upon the satisfactory dividend declared by Callenders, the company's 6½ per cent. preference shares rose a florin to 25s. 9d., but the ordinary shares are unchanged at 51s. 3d. British Insulated ordinary advanced to 55s., and General Electrics to 35s. 9d. Johnson & Phillips are 1/16 down at 17s. 6d. Siemens pleased the market by announcing a repetition of the previously paid 7½ per cent. dividend. This made no difference to the price, which remained at 20s. Associated Electrical Industries ordinary shares weakened to 16s. 3d. Ever-Ready shares are 6d. down at 22s. There is an active market in the new issue on the basis of 10s. 6d. premium.

The British Light & Power Corporation secured ready subscription for the 600,000 6 per cent. preference shares of £1 each, offered last week at par. The market price started at 3d. discount to 3d. premium.

Babcock & Wilcox have again suffered; the price is 6d. lower at 38s. 3d. Vickers remain about 6s. 3d.

Share List of Electrical Companies

Home Electricity Companies.

	Nom.	Approx. Dividend. 1930.	1931.	Price. May 17.	Rise or Fall.	Yield p.c. £ s. d.
Bournemouth and Poole	1	15	15	60/9	—	4 18 9
Brompton Ordinary	1	8½	8½	28/–	—	5 0 0
Central Electricity 4½% Deb.	Stock	4½	4½	95½	—	4 14 1
Charing Cross Ordinary	1	8½	8½	29/–	—	4 16 7
Chelsea	1	8½	8½	26/6	—	5 5 8
City of London	1	10	10	37/6	—	5 6 8
Clyde Valley	1	8	7	27/6	—	5 1 10
County of London	1	11	10½	42/6	+6d.	4 18 10
Edmundsons' 7% Pref.	1	7	7	26/–	—	5 7 8
Elec. Dis. Yorkshire	1	9	9	35/–	—	5 2 10
Elec. Supply Corporation	1	11	—	47/6	—	4 12 7
Kensington Ordinary	1	8	8	28/6	—	4 18 3
Lancs. Light and Power	1	6½	7	26/3	—	5 6 8
London & Home Counties 4½% Deb.	Stock	4½	4½	96½	—	4 13 3
London Electric	1	9	9	28/–	—	5 0 0
Metropolitan	1	10	10	41/3	—	4 17 6
Midland Counties	1	7	7	28/9	+6d.	4 17 5
Mid. Elec. Power	1	8	8	30/6	—	5 5 0
Newcastle-on-Tyne Ordinary	1	6	6	23/9	+6d.	5 1 1
Do. 7% Pref.	1	7	7	27/6	—	5 1 10
Northampton	1	10	10	40/9	—	4 18 2
Notting Hill 6% Pref.	10	6	6	11	—	5 9 1
North Met. Elec. 6% Pref.	1	6	6	24/6	—	4 18 0
St. James' and Pall Mall	1	8	8	28/–	—	5 0 0
Scottish Power	1	8	—	28/3	—	5 13 3
South London	1	8½	8½	28/–	—	5 0 0
Urban Ordinary	1	7	—	28/–	—	5 0 0
Westminster Ordinary	1	8½	8½	28/–	—	5 0 0
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	16/3	+1/9	9 4 8
Yorkshire Elec.	1	8	8	33/9	—	4 14 10

Home Rails.

Central London Ord. Assented	Stock	4	4	72½	—	5 10 4
Metropolitan	,,	4	3½	44½	—	7 17 3
Do. District	,,	5	4½	51½	—	8 14 10
Underground Electric	1	8	7	17/–	—	8 4 8

Telegraphs and Telephones.

		1929.	1930.			
American Tel. & Tel.	$100	9	9	135	—	6 13 4
Anglo-Am. Tel. Pref.	Stock	6	6	97½	—	6 3 1
Do. Def.	,,	1½	1½	23	—	6 10[1]5
Cables & Wireless 5½% Pref.	,,	5½	5½	41½	+1	—
Do. A 7½% Ord.	,,	Nil	—	14	+1	—
Do. B Ord.	,,	Nil	—	8½	+½	—
Globe Tel. and T. Ord.	10	10	8½	4½	—	—
Do. do. Pref.	10	6	6	6½	—	9 4 8
Great Northern Tel.	10	20	20	23	+½	8 13 10
Marconi-Marine	1	15	15	24/6	—	8 3 4
Oriental Telephone Ord.	1	12	12	2⅜	—	*5 1 1

Home and Foreign Trams, etc.

Anglo-Arg. Trams First Pref.	5	5½	—	6/3	—	—
Do. do. 2nd Pref.	5	6	—	3/9	—	—
Do. do. 5% Deb.	Stock	5	5	8	–1	—
British Electric Traction Def. Ord.	,,	5	5	650	–25	—
Do. do. Pref. Ord.	,,	8	8	121½	+2	6 11 9
Brazil Traction	100	8	—	12	—	—
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	90½	+1	5 11 0
London & Sub. Trac. 5% Pref.	1	Nil	Nil	3/9	—	—
London United Tram Deb.	Stock	4	4	57½	—	6 19 2
Mexico Trams, 5% Bonds	—	5	5	32⅜	—	15 7 8
Mexico Light Common	100	Nil	Nil	12½	–3	—
Do. 7% Pref.	100	7	7	22½	–3	27 9 0
Do. 1st Bonds	—	5	5	57½	–5	8 13 10
Victoria Falls Ord.	1	15	15	56/3	—	5 6 9
Yorkshire (West Riding)	1	Nil	Nil	5/3	—	—

Manufacturing Companies.

Assoc. Elec. Ord.	1	6	6	16/3	–⅛	4 18 6
Do. Pref.	1	8	8	28/3	—	5 13 3
Babcock & Wilcox	1	15	14	38/3	–6d.	7 6 7
British Aluminium Ord.	1	10	10	22/–	–6d.	4 11 0
British Insulated Ord.	1	15	15	55/–	+⅛	5 9 0
Brush Ord.	Stock	10	5	55	—	9 1 8
Callender's	1	15	15	51/3	—	5 19 3
Do. 6½% Pref.	1	6½	6½	25/9	+2/–	5 1 0
Crompton Parkinson Ord.	5/–	30	30	17/6	—	8 11 6
Do. 8% Pref.	1	8	8	27/6	—	5 16 5
Edison-Swan 1st Pref.	1	7½	7½	23/3	—	6 9 0
Do. 5% Deb.	Stock	5	5	89½	—	5 11 10
Electric Construction	1	5	Nil	7/6	—	—
Enfield Cable Ord.	1	25	25	3⅜	—	7 8 2
English Electric	1	Nil	Nil	8/9	—	—
Do. do. Pref.	1	Nil	Nil	10/–	—	—
Ever Ready	5/–	35	35	22/–	–6d.	7 19 1
Ferranti Pref.	1	7	7	22/–	—	6 7 3
G.E.C. Pref.	1	6½	6½	26/–	—	5 0 0
Do. Ord.	1	14	10	35/9	+9d.	5 12 0
Henley's	1	30	30	4½	—	6 3 6
Do. 4½ Pref.	5	4½	4½	4½	—	5 6 9
India-Rubber	1	Nil	Nil	4/6	—	—
Johnson & Phillips	1	10	10	½	–1/16	5 14 3
Siemens Ord.	1	7½	7½	20/–	—	7 10 0
Telegraph Construction	12	10	7½	10	—	—

* Dividends paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1930

26,467. "Methods of and apparatus for recording sound and sound records." Western Electric Co., Ltd. (Bell Telephone Laboratories, Inc.). June 4th, 1931. (371,464.)

30,746. "Electrodes for thermionic tubes." A. Schwitzer and B. Erber (trading as G. Ganz & Co.) July 3rd, 1930. (371,419.)

31,905. "System for supervising and controlling the parts of electrical distribution networks." Siemens & Halske Akt.-Ges. November 6th, 1929. (371,421.)

32,031. "Manufacture of coated electrodes for electric arc welding and other processes of fusion deposition of metals." B. Turner and Ferro-Arc Welding Co., Ltd. October 24th, 1930. (371,422.)

38,098. "Telemetering systems." International General Electric Co., Inc. December 18th, 1929. (371,424.)

38,213. "Apparatus for passing electric currents through gases." G. G. A. Brion and A. J. Krutzsch. December 18th, 1930. (371,398.)

38,544. "Entry of electric cables into cable boxes and other apparatus." C. A. M. Henderson. December 22nd, 1930. (371,400.)

1931

1,030. "Luminous signalling device for securing safe landing of airplanes at night." G. Soucek. January 12th, 1931. (371,383.)

1,166. "Oil circuit-breakers." British Thomson-Houston Co., Ltd. (General Electric Co.). January 13th, 1931. (371,340.)

1,278. "Dynamo-electric machines." British Thomson-Houston Co., Ltd. January 17th, 1930. (371,427.)

1,580. "Electrical terminal connectors." C. R. Cook. January 16th, 1931. (371,404.)

1,745. "Incandescent cathode rectifying valves." F. Meyer. January 20th, 1930. (371,351.)

1,768. "Oscillatory electric motors." C. Appelmans. January 22nd, 1930. (371,432.)

1,803. "Drying and impregnating of electric cables." Telefonaktiebolaget L. M. Ericsson. February 7th, 1930. (371,354.)

1,804. "Telephone systems." Automatic Electric Co., Ltd., and R. Taylor. January 19th, 1931. (371,355.)

1,808. "Protective devices for electric insulators." Bullers, Ltd., and H. C. R. Dagnall. January 19th, 1931. (371,357.)

1,827. "Electrical means for measuring the fuel-injection periods of internal-combustion engines." J. Lucas, Ltd., E. A. Watson, and J. A. Laird. January 20th, 1931. (371,362.)

1,900. "Train control and/or cab signalling systems." Associated Telephone & Telegraph Co., and A. E. Hudd. January 20th, 1931. (Patent of addition not granted.) (371,368.)

1,902. "Carrier-current signalling systems." Associated Telephone & Telegraph Co. January 23rd, 1930. (371,369.)

1,905. "Illuminated electric signs for advertising or other purposes." A. E. Chapman. January 20th, 1931. (371,370.)

1,919. "Electric rare gas discharge lamps." J. M. E. de Beaufort and A. Lederer. February 22nd, 1930. (371,372.)

1,956. "Circuit arrangement for telegraphic installations." C. Lorenz Akt.-Ges. January 23rd, 1930. (371,376.)

2,012. "Traffic signal systems." E. E. Hopwood, E. N. Bray, and E. N. Bray, Ltd. January 21st, 1931. (371,391.)

2,042. "Radio receiving apparatus." E. K. Cole, Ltd., E. J. Wyborn, and A. W. Martin. January 21st, 1931. (371,438.)

2,154. "Electrical communication cable circuits." Standard Telephones & Cables, Ltd., and K. E. Latimer. January 22nd, 1931. (371,411.)

2,183. "Electric battery lamps for vehicles." C. Langbein (trading as firm of C. Langbein). January 23rd, 1930. (371,413.)

2,205. "Switchgear for electric transformers." B. Jansen. January 22nd, 1931. (371,414.)

2,216. "Type-printing telegraph instrument with line-feed device for sheet printing." Siemens & Halske Akt.-Ges. February 3rd, 1930. (371,415.)

2,292. "Electrical measuring apparatus." L. E. Ryall. January 23rd, 1931. (371,443.)

2,364. "Electrical signalling apparatus for use on motor and other road vehicles." W. S. Thimblethorpe. January 24th, 1931. (371,453.)

2,397. "Electric lamps for the floodlighting of shop windows and the like." J. Lawton & Sons, Ltd., and F. G. Martin. January 24th, 1931. (371,456.)

2,756. "High-voltage systems." W. W. Triggs (Ohio Brass Co.). January 28th, 1931. (371,471.)

2,822. "Electrolyte for galvanic cells." J. J. Pala. January 28th, 1931. (371,478.)

3,166. "Master controllers for electric motor control systems." British Thomson-Houston Co., Ltd., and J. H. Cansdale. January 31st, 1931. (371,489.)

3,317. "Dielectric materials." British Thomson-Houston Co., Ltd. February 1st, 1930. (371,492.)

3,406. "Telegraphic transmission of typographical matter." G. Westover, R. C. Elliott and Monotype Corporation, Ltd. February 3rd, 1931. (371,495.)

3,461. "Hotel and like signalling systems." Phœnix Telephone & Electric Works, Ltd., and F. G. Bell. February 3rd, 1931. (371,497.)

3,649. "Microphones." Coventry Automatic Telephones, Ltd., C. C. Puckette, and E. P. Fairbairn. February 5th, 1931. (371,501.)

3,692. "Diaphragms for galvanic cells." J. P. Gjerulff. August 26th, 1930. (371,502.)

4,201. "Means for making connections with electric cables." Callender's Cable & Construction Co., Ltd., G. S. Boothroyd and S. E. R. Beecroft. February 10th, 1931. (371,510.)

5,135. "Television and like apparatus." J. L. Baird and Baird Television, Ltd. February 18th, 1931. (371,520.)

5,681. "Telephone systems." Siemens & Halske Akt.-Ges. February 22nd, 1930. (371,525.)

6,999. "Telephone systems." Coventry Automatic Telephones, Ltd., and J. E. Collyer. March 6th, 1931. (371,535.)

7,069. "Resistance elements for electric heating bodies and processes of manufacture thereof." E. Challet. March 10th, 1930. (371,536.)

7,167. "Electric current generating systems." Chance Bros. & Co., Ltd., and J. H. Abbink-Spaink. March 7th, 1931. (371,538.)

7,532. "Electric fuses." E. Dobson, and Foster Engineering Co., Ltd. March 11th, 1931. (371,544.)

7,610. "Loading of submarine electric signalling cables." Siemens Bros. & Co., Ltd., and H. G. Wood. March 12th, 1931. (371,545.)

8,022. "Television apparatus." F. Horny. March 16th, 1931. (371,549.)

8,334. "Wireless navigation systems." M. Wallace. May 6th, 1930. (371,552.)

8,336. "Electric induction furnaces." Electric Furnace Co., Ltd. March 18th, 1930. (371,553.)

8,486. "Electric switches." C. W. Kuhn. March 20th, 1930. (371,557.)

9,126. "Wireless signalling systems for controlling tuned electro-mechanical relays." P. C. Ricchiardi. March 31st, 1930. (371,565.)

9,353. "Stranding machines." Callender's Cable & Construction Co., Ltd., and H. Hill. March 27th, 1931. (371,567.)

11,026. "Methods of creating high vacuums in electric discharge devices." British Thomson-Houston Co., Ltd. April 14th, 1930. (371,590.)

11,288. "Switches for selectively controlling electrical circuits." S. W. Thimblethorpe. April 16th, 1931. (371,595.)

12,866. "Television." Communication Patents Inc. October 1st, 1930. (371,612.)

13,113. "Electric lamp fittings." General Electric Co., Ltd., H. T. Steggles, and A. J. L. Whittenham. May 4th, 1931. (371,614.)

13,715. "Electrical installations." General Cable Corp. May 30th, 1930. (371,625.)

14,125. "Electric push-pull switches." A. W. Macnamara. May 13th, 1931. (371,631.)

15,051. "Means for producing music electrically." British Thomson-Houston Co., Ltd. May 22nd, 1930. (371,641.)

15,053. "Systems for producing music electrically." British Thomson-Houston Co., Ltd. May 22nd, 1930. (371,642.)

15,220. "Extinguishing chambers for electric switches." International General Electric Co., Inc. May 26th, 1930. (Addition to 352,837.) (371,646.)

15,887. "Electrically heated utensils." N. Dennes, and Associated Electrical Industries, Ltd. May 30th, 1931. (371,650.)

16,246. "Electrical measuring or indicating instruments." F. W. W. Highfield, and Highfield Electrical Co., Ltd. June 4th, 1931. (371,654.)

16,825. "Echo eliminating arrangements in electric transmission systems." Lignes Télégraphiques et Téléphoniques. July 3rd, 1930. (371,664.)

17,152. "Means for connecting oil-filled electric cables." Siemens-Schuckertwerke Akt.-Ges. July 4th, 1930. (371,668.)

17,582. "Voltage-regulating transformers." Dr. O. Lobl. July 1st, 1930. (371,670.)

18,020. "Electric discharge lamps and method of operating the same." British Thomson-Houston Co., Ltd. June 24th, 1930. (371,673.)

1932

3,364. "Electric cable systems." Soc. Italiana Pirelli. February 5th, 1931. (371,788.)

6,596. "Electrical terminal connectors." C. R. Cook. January 16th, 1931. (Divided application on 371,404.) (371,418.)

Trade Mark Applications

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from May 11th :—

Edac. No. 528,910. Class 6. Vacuum cleaning machines, electric fans, hair-drying machines, floor polishing machines, sewing machine motors and electric blowing machines. No. 528,911. Class 11. Electric massage apparatus.—C. H. Twigg, trading as the Electric Domestic Appliance Co., 6, Kingstanding Road, Perry Barr, Birmingham.

Genalex. No. 530,197. All goods in Class 6. No. 530,198. Class 8. Telegraphic, telephonic and wireless telegraphic and telephonic instruments and apparatus and parts thereof, electricity meters and measuring instruments, electrically operated cinematograph apparatus, electric lamps for scientific purposes, electrically operated speed, distance and pressure indicators, pyrometers, rheostats, and electric signalling apparatus. No. 530,199. Class 11. Accumulators and batteries, induction coils, magneto machines, massage apparatus, and similar goods, all for medical and surgical purposes. No. 530,200. Class 13. Electrical goods and fittings, and electric lamps (ordinary). No. 530,201. Class 15. Globes, shades and screens made of glass and used for illuminating purposes. No. 530,202. Class 18. Electric heating apparatus for buildings, electric ovens, and refrigerating chambers.—General Electric Co., Ltd., Kingsway, W.C.2.

Magic Wind. No. 531,004. Class 6. Vacuum cleaning machines.—British Vacuum Cleaner & Engineering Co., Ltd., Parson's Green Lane, S.W.6.

Atonic. No. 530,928. Class 8. Electric batteries (not for medical purposes) and fitted electrical switchboards.—The Alton Battery Co., Ltd., Alton, Hants.

Aurora. No. 530,102. Class 13. Electric lamps (ordinary).—J. B. McGillivray, 66, Carfillan Drive, Cardonald, Renfrewshire.

Restor (lettering and design). No. 529,274. Class 13. Motor vehicle lamps and electric lamps (ordinary).—Société des Etablissements Restor et Projecteurs Marsal Réunis, Neuilly-sur-Seine, France (British representatives: Marks & Clerk, 57-58, Lincoln's Inn Fields, W.C.2).

Clarmac. No. 529,630. Class 18. Electrically heated boilers for use in road making for boiling tar and similar materials.—Clarmac Engineering Co., Ltd., 48, Payne Street, Port Dundas, Scotland.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aberdeen.—Houses (258); city architect.

Aberystwyth.—Pavilion (£15,000), Waterloo site; borough surveyor.

Acomb (YORKS).—Cinema for Manor Cinemas (York), Ltd.; T. Thompson, governing director of Thompson's Enterprises, Ltd., Middlesbrough.

Acton.—Church of St. Martin's (£6,500); W. Daley & Co., Ltd., 58, Birchgrove.

Banbury (OXON).—Houses (160), for T.C.; James Hobson and Sons, Ltd., builders, Nottingham.

Bedlington (NORTHUMBERLAND).—Houses (60), Stakeford; U.D.C. surveyor, J. W. Pooley, Council Offices.

Belford (NORTHUMBERLAND).—Housing development scheme at Beadnell; Hicks and Charlewood, architects, 4, Mosley Street, Newcastle.

Betteshanger (KENT).—Pithead baths (£25,000); Dorman Long and Co., Ltd.

Birmingham.—Houses (269), Glebe Farm Estate; H. H. Humphries, city engineer, Council House. Council school, Hobmoor Road, Yardley; B. Whitehouse & Son, Ltd., builders, Monument Road.

Blyth.—Flats (24); Berg & Turnbull, builders.

Bridlington (YORKS).—Concert hall; P. Maurice Newton, borough architect, Town Hall.

Buckhaven.—Houses (32); Peter Sinclair, architect, 305, Wellesley Road, Methil.

Calne (WILTS).—Houses (36); borough surveyor.

Cardiff.—School, Llanishen, for E.C.

Carlisle.—Houses (64), Old Greystone; city surveyor. Church, Shady Grove Road; Carlisle Diocesan Board.

Caterham.—Houses (27), Milner Road; E. O'Sullivan (Kenley), Ltd.

Cheltenham.—Ice rink, swimming bath, restaurant, &c., Winter Garden site; J. R. Wilkins.

Chesham.—Houses (24) for U.D.C.; F. T. Moss, surveyor.

Cheshire.—Council school, Ellesmere Port; F. A. Browne, county architect, County Offices, Chester.

Chigwell (ESSEX).—Houses (1,700), for L.C.C.

Colchester.—Additions to nurses' home, Severells Mental Hospital (£7,500), and hospital extensions (£44,387); W. H. Morgan, Essex county architect, Old Court, Chelmsford.

Dewsbury.—Bus station, Asman Square, for the Yorkshire (W.D.) Electric Tramways, Ltd.; S. M. Wright, secretary, 88, Kingsway, W.C.2.

Dundee.—Houses (70); city architect.

Ealing.—Houses (108), Rosedene Avenue and Drive, and Ferrymead Avenue, for the North-West London Estates Co., Ltd.; S. R. Hayes, architect, "Arlington," Morningside Road, Worcester Park, Surrey. Houses (315), Greystoke Estate (Part 3); London and Provincial Building Co., Ltd., 113, Park Street, W.1. Additions to King Edward Memorial Hospital, Mattock Lane; Hall-Jones & Dewhirst, architects, Ealing, W.5.

Edinburgh.—R.C. church, Restalrig (£20,000); Sir G. G. Scott, architect, 7, Gray's Inn Square, W.C. Central Hall, Leith (£20,000), for the Wesleyan trustees; secretary. Re-erection of factory, Dumbiedykes, for A. Cowan & Sons, Ltd., Craigside Works (£25,000).

Essex.—Senior school, Sawyers Hill Lane, Brentwood, and High School for Girls (£44,265), Romford; W. H. Morgan, county architect, Old Court, Chelmsford.

Farnham.—Houses (30), Crondall Lane; U.D.C. surveyor.

Fifeshire.—Houses, Kincardine (48) and Kelty (76); county surveyor, Cupar. Mining school, Cowdenbeath; director of education, Cupar.

Gateshead-on-Tyne.—Reconstruction of the Grey Nags Head Hotel, High Street; W. E. Hall, Ltd., builders, Derwentwater Road.

Glasgow.—Church, Croftfoot, Cathcart; Western Heritable Investment Co., Ltd. Wharf, Dalmuir Sewage Works (£28,388); H. M. Murray & Co., 121, West Regent Street, Glasgow. Cinema, Sinclair Drive, for J. Hamilton, 51, Melville Street, Pollokshields; Cowieson's, Ltd., St. Rollox.

Grantham.—Rebuilding business stores, High Street, for Montague Burton, Ltd., Leeds.

Great Harwood (LANCS).—Small holdings (68 acres), Martholme Farm; Lancashire County Agricultural Committee.

Great Yarmouth.—Houses (126); borough engineer.

Halifax.—Works extension; G. H. Gledhill & Sons, Trinity Works.

Harrogate.—Covered promenade, with sun parlours and tea house (£22,000); borough surveyor.

Hebburn-on-Tyne.—Workshop for A. Reyrolle & Co., Ltd.; Cackett, Burns, Dick & McKellar, architects, 21, Ellison Place, Newcastle.

Hemel Hempstead.—Factory for Landon's Granulated Fertiliser Co.

Hexham (NORTHUMBERLAND).—Houses (100); W. G. Landale, U.D.C. surveyor, Hexham House.

Howden-le-Wear.—Installation of electric lighting in Workmen's Institute; Wm. Dunn, secretary, Church Street.

Huddersfield.—Wesleyan church, Thornton Lodge (£7,000); H. A. Kellett, architect.

Huntingdon.—Cinema; Ward & Woolnough, architects, Wisbech.

Hyde.—Houses (58), Werneth Avenue and Mottram Old Road; borough engineer.

Jedbergh (ROXBURGH).—Houses (52), Broomtrees site; borough surveyor, Council Offices.

Kendal.—Houses (111), Kirkbarrow; borough surveyor.

Kirkintilloch.—Houses (75); borough surveyor.

Leavesden (HERTS).—Film studios and housing scheme (£300,000); P. E. Stenning, London.

Leicester.—Central police station (£50,000); borough surveyor.

Lincoln.—Elementary school, Macaulay Drive, St. Giles; G. Watkins, architect, Silver Street.

Liverpool.—School, Norris Green; Rev. J. Ahearne, St. Teresa's Presbytery, Norris Green. Post Office, Hatton Garden (£100,000); H.M. Office of Works.

London.—(CAMBERWELL).—Post Office, 304, Camberwell Road; H.M. Office of Works. (EAST HAM).—Electric lighting installation, Shaftesbury and Storey Street schools, for the Borough E.C.; F. R. Thompson, secretary. (LEWISHAM).—Houses (26), Henryson Road; J. W. Heath & Son. Houses (99), Selworthy Road; W. Clark.

Macclesfield.—Houses (32), Ivy Road; F. Marsland.

Malvern (WORCS).—Houses (38); W. O. Thorp, U.D.C. surveyor.

Manchester.—Works, Trafford Park, for Thomas Hedley and Co., Ltd., Newcastle-on-Tyne.

Middlesbrough.—Cinema, Acklam Road, for J. Reubens; W. E. Haslock, architect, Albert Road.

Newmarket.—Houses (36), for R.D.C.; A. E. Austin, surveyor, Exning Road.

Northfleet (KENT).—Houses (100), Wombwell Park Estate; J. A. Mitchell, U.D.C. surveyor.

Norwich.—Municipal offices (£250,000); James & Rowland, architects, 33, Bedford Place, W.C.1. School (£6,436), Household House Estate, for Borough E.C.

Nottinghamshire.—School, Walesby Road, Ollerton; County E.C.

Oswestry (SALOP).—Houses (25), Llwyn Farm Estate; borough surveyor.

Padiham.—Houses (64); surveyor to the U.D.C., Council Offices.

Penzance.—Houses (82), Penalverne site; F. Latham, borough surveyor, Penzance.

Poole (DORSET).—School, Rossmore; director of education.

Portsmouth.—Houses (29), Devon Road; G. Wallis. Art gallery, High Street (£2,500); city engineer.

Rawtenstall.—Rebuilding the Black Dog Hotel, Crawshawbooth; licensee.

Rugby.—Cinema, Newbold Road and North Street (£50,000); W. H. Jones & Sons, Ltd., builders, Lockhurst Lane, Coventry.

Scarborough.—Church, Scalby Road; Scarborough Church Extension Committee.

Seaford (SUSSEX).—Seven Sisters Hotel, Alfriston Road; Rock Brewery Co., Ltd., St. James' Street, Brighton.

Selby (YORKS).—Houses (42); R.D.C. surveyor.

Sheffield.—Baptist Church, Abbey Lane; Rev. T. J. Whitman, 28, Thornsett Road.

Shipley.—Dairy premises, Thomas Place; Windhill Co-operative Society, Ltd.

Solihull.—Houses (32) for U.D.C.; Woods & Brown, builders.

Southend-on-Sea.—Rebuilding Mascot Cinema, Westcliff; proprietor.

Southgate.—Development, Roseneath Estate; G. W. S. Ingram.

Southowram (YORKS).—Houses (32), Bank Top, for Mrs. R. H. Sutcliffe; C. E. Fox, architect.

South Shields.—Rebuilding of the Grand Electric Cinema, Ocean Road; J. H. Morton & Sons, architects, Fowler Street.

Sunderland.—Houses (154), Marley Potts Estate, for the T.C.; W. D. Allison, builder, Whitburn, near South Shields. Houses (278), Westmoor Road, Carley Hill, Commercial Road Estate and Newcastle Road; T. P. Collinge, borough engineer, Town Hall.

Surbiton (SURREY).—Bus garage, London and General Omnibus Co., Ltd. Houses (52) and shops (12); U.D.C. surveyor.

Timperley.—Two schools; director of education, Education Offices, Chester.

Torquay.—Estate development, off Cadewell Lane; W. J. French.

Tottenham.—Houses (23), Lordship Lane; C. J. Pilgrim & Sons.

Walsall.—School, off Birmingham Road, for Rev. L. D. Hammond; J. R. Deacon, builders, Algernon Street. Houses, Delves Estate (£12,300); G. Insley, Ltd., builder, Walsall.

Warwickshire.—Isolation hospital; D. H. Brown, county architect, 8, Northeate Street, Warwick.

Watford.—Showroom extensions; F. Clements, The Parade.

Winchester.—Houses (80) (with electrical work) for the T.C.; Bennett Bros., builders, Letchworth, Herts.

Windermere.—Extensions, Beech Hill Hotel, for Arthur Riley; John Hutton, architect, Kendal.

York.—Houses (186) and flats (16), Garrow Hill Estate; F. W. Spurr, city engineer, Guildhall.

Photo-cell Counters

Photo-electric cell counting gear for checking coupons as they are inserted in packets of chocolate has been fitted to all the packing machinery at Messrs. Nestlé's factory at Hayes, Middlesex, by the General Electric Co., Ltd. As each coupon is fed into a packet it overlaps a small hole through which light from a 12-V 24-W "Osram" automobile lamp shines on to a photo cell which is connected in a standard amplifier circuit. Also a cam on the shaft of the feeding arm closes the anode circuit of a P.610 "Osram" valve, this circuit being normally open. Therefore when this switch is closed one of two things will happen. If there is a coupon obscuring the light, the photo cell will operate the relay which will actuate the counter. If there is no coupon the relay will not operate and the no-volt release of the motor will be actuated, this being accomplished by means of a second pair of contacts on the relay. Thus a complete record is made of the number of coupons used. In addition the packing machine stops if for any reason one is missing.